TV & VIDEO * AUDIO * COMPUTERS * VINTAGE RADIO!

WIN ONE OF SIX NEW FLUKE SCOPEMETERS!

Electronics

AUSTRALIA WITH Professional Electronics & ETI

JUNE 1997 $5.50
NZ $7.20 incl GST

PANASONIC'S HOT NEW *DIGITAL* CAMCORDER:

Review Inside...

NASA'S MARS PATHFINDER AND ITS MINI ROVER

TURN ON YOUR HOME COMPUTER FROM THE OFFICE!

9 312966 123633 06

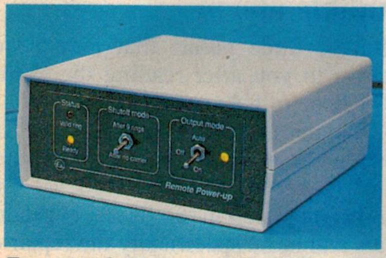
Print Post Approved PP255003/01056

Electronics AUSTRALIA with Professional Electronics & ETI

Volume 59, No.6
June 1997

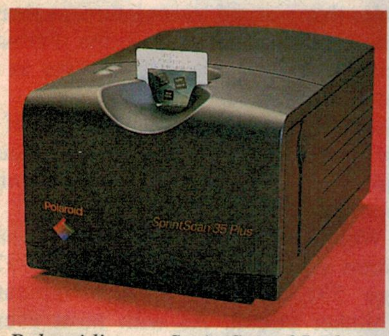
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Remote power control



Ever sat down to start work, only to realise that a file you need is still back on the hard disk of your home PC — and no-one is at home to turn it and its modem on? Rob Evans' new Power-Up project is designed to solve just this kind of problem. It lets you turn on your PC with a phone call, and have it call you back for remote access to the files. See Rob's writeup starting on page 54.

Compact 35mm scanner



Polaroid's new SprintScan 35 Plus is a compact desktop scanner for 35mm transparencies that delivers genuine 2700dpi resolution and 12-bit/channel internal range. Many images in this issue were scanned with one. Our review starts on page 30...

On the cover

Panasonic's new NV-DX1EN digital video camcorder is an excellent representative of the 'new breed' of fully digital models. It uses three 1/3" CCD image sensors, and delivers very close to full broadcast quality recordings. To find out more, see Louis Challis' review starting on page 10. (Photo by Barry Slade.)

World of Electronics

Projects and Technical

Columns and Comments

Departments

Professional Electronics

MANAGING EDITOR
Jamieson Rowe, B.A., B.Sc., SMIREE, VK2ZLO
TECHNICAL EDITOR
Rob Evans, CET (RMIT)
PROJECT DESIGNER/WRITER
Graham Cattley
PRODUCTION EDITOR
Witold Budzynski, B.Sc.
CONTRIBUTORS
Louis Challis
Arthur Cushen, MBE
Roger Johnson, VK5ZKP
Jim Lawler, MTETIA
Jon Loughron, Assoc. Dip. Elect.
Tom Moffat, VK7TM
Peter Phillips, B.Ed., Dip Ed., ECC
Nick de Vries, MIAME, AMSAE
READER SERVICES CO-ORDINATOR
Ana Marie Zamora; phone (02) 9353 0620
DRAFTING
Drawquick Computer Graphics
COVER DESIGNER
Clive Davis
ADVERTISING MANAGER
Selwyn Sayers
Phone (02) 9353 0734; fax (02) 9353 0613
ADVERTISING PRODUCTION
Tim Cooney; phone (02) 9353 0740
PRODUCTION
Ray Eirth
CIRCULATION MANAGER
Michael Prior
HEAD OFFICE - EDITORIAL
PO Box 199, Alexandria 2015.
180 Bourke Road, Alexandria 2015.
Phone (02) 9353 0620; fax (02) 9353 0613
E-mail: electaus@magna.com.au

Subscriptions Enquiries:
phone (02) 9353 9992; fax (02) 9353 0967.
Computer Bulletin Board: (02) 9353 0627

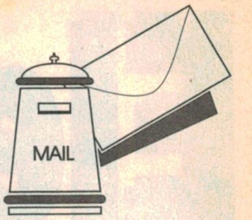
INTERSTATE ADVERTISING SALES
MELBOURNE: Pilar Misa, 504 Princes Highway, Noble Park, 3174.
Phone (03) 9213 3222; fax (03) 9701 1534.
BRISBANE: Graham Smith, 26 Chermside Street, Newstead 4006.
Phone (07) 3854 1119; fax (07) 3252 3692.
ADELAIDE: Sue Bowshall, 98 Jervois Street, Torrensville, 5031.
Phone (08) 352 7937; fax (08) 352 6033.

ELECTRONICS AUSTRALIA is published by Federal Publishing Company, a division of Eastern Suburbs Newspapers Partnership, which is owned by General Newspapers Pty Ltd.
A.C.N.000 117 322,
Double Bay Newspapers Pty Ltd.
A.C.N.000 237 598, and
Brehmer Fairfax Pty Ltd.
A.C.N.008 629 767,
180 Bourke Road, Alexandria, NSW 2015.

Printed by Macquarie Print, 51 - 59 Wheelers Lane, Dubbo 2830. Phone (068) 843 444.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Rd, Alexandria 2015; phone (02) 9353 9911.
ISSN 1036-0212
* Recommended & maximum Australian retail price.

Member of the Audit Bureau of Circulations

LETTERS TO THE EDITOR



HP scope winner

I am just writing to say thank you very much for the Hewlett Packard 54645A Oscilloscope I won in your recent subscription competition. As a family man I could never have afforded such an excellent instrument.

Keep up the good work, and thank you very much!

John Robinson,
Parkdale, Vic. (via e-mail)

Neville Williams

On behalf of the Historical Radio Society of Australia, I wish to accord our collective acknowledgement of Neville Williams' contribution to our enjoyment of our hobby and have written separately to offer our most heartfelt condolences to Neville's family.

For quite a few of our members, Neville's writings on matters electronic was indeed the inspiration for many a satisfying career and for countless many more, provided a recreational interest and understanding of technical matters from boyhood times onwards.

His writing style was so personal and lucid that many of us felt we actually knew Neville! His melding of technical knowledge and historical developments into our social fabric has been a fascination right until the end, and we would like to request of your goodself as to whether *Electronics Australia* would consider publishing a collection of at least his 'When I Think back' series.

Tony Lightfoot, Secretary
Historical Radio Society of Aust.,
Mount Waverley, Vic.

URL for Jeeves

The URL given on p78 of the February 1997 issue for the Smart Company, distributors of Jeeves Electronic Systems, **http://www.-senet.com.au/~hsp/home.htm** is a dud; not even the user directory is found.

The one for X-10 isn't really very satisfactory, either; **http://www.midac.-com.au** is usable, but **http://www.-ozemail.com.au/~midac/x10.htm** is a lot more useful.

Rod Speed
(via e-mail)

There do seem to have been some changes to the URLs for these companies, Rod. The new one for the Smart Company seems to be: **http://www.-iinet.net.au/~jeeves/index.html**.

Audible alarm

I have three points that may be of interest to you after reading the March 1997 issue of EA:

1. You missed the most vital stage in your 'audible alarm for critical car systems' (page 46), a low water level sensor. Having been in the 'trade' for many years and more specifically the repair of trucks, I have to wholeheartedly agree with the statement made by your 'engine reconditioner', that overheating is the major cause of engine failure. However, simply checking the output from the engine thermal sensor won't do. In most instances involving expensive repairs, coolant is lost quite suddenly, as when a hose blows (heater especially), or maybe a head gasket.

When coolant is lost in this way, the thermal sensor nearly always indicates a cooler than normal temperature, as there is no liquid in contact with the thermal element. Believe me, it's all over in a matter of minutes.

Actually I seem to remember part of a low water detection circuit in your Curcuit & Design Ideas of the month from February.

2. Which bring me to my next point. Circuit & Design Ideas (March 1997, page 53) describes a turn indicator/blinker circuit. As with most everything else today, flasher cells also have regulations governing their operation. One of these requirements is the detection of a bulb out (blown!) condition and a means of conveying this info to the driver. This is usually achieved by an increase in the flash pulse rate. In many instances this can be twice the normal pulse rate.

So beware, those who choose to use this circuit, it's not strictly legal.

3. For those wishing to develop microcontroller products, get in touch with Avnet Pacific and get hold of a 'Picstart Plus' development system by Microchip. In my opinion Microchip produce the best in microcontroller technology at very reasonable prices.

Their development system is fantastic, with a great Win 3.1 interface, and a programmer that will do literally their whole range, from 8-pin through to 40-pin 'grunters'. Their 16F84 EEPROM controller is a breeze to use and allows really fast development. A/D, comparators, PWM, and lots of other stuff is available onboard, with a large range of chip options.

Microchip leaves the opposition for dead. Their RISC instruction set is easy to learn, there's mountains of information available on the 'net', and best of all, Microchip's 'helpdesk' via email is positively prompt and helpful.

Incidentally, I also agree with those who believe more projects need to be developed using microcontroller/-processor technology. As they say, that's the way the world is going.

4. That Tom Moffat, he's the man. Keep up the great articles, Tom.

Mike Clarke,
Hamilton, NZ. (by e-mail)

Double adaptors

I read with interest Roger Johnson's comments, as well as those in your Forum column, concerning the old style double adaptors which transpose the active and neutral.

Back in the early 60s, as an aspiring technician, I got my first decent 'boot' from a Variac which was wrongly wired at the mains plug. After that I soon learnt it was equally common to find power points wired the same way, both in the domestic situation and the workplace.

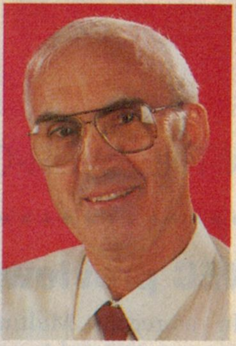
Many radio sets of the era had the 'neutral' connected directly to the chassis and a frequent complaint from their owners was that the control knobs 'bit' them (through the metal grub screws). On one occasion I was discussing the high incidence of such events, and the inconvenience to the serviceman, with an older and wiser hand. His solution — you guessed it — the device in question.

To this very day I still have one in my tool kit, and it is particularly useful for checking out those spike protectors with the three neons, which people use on their fax machines.

John Harvey
Clermont, Qld. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Electronic imaging: boom technology of 1997?

With developments coming so thick and fast in so many different areas of electronics, it's easy to become blase about it all. Somehow Gordon Moore's law, about memory chip capacity and processor chip horsepower doubling every 18 months or so, seems to have expanded into so many facets of electronics as a whole that we're all in danger of suffering from the MEGO effect: 'My Eyes are Glazing Over'.

All the same, I for one can't help but be impressed by the dramatic developments now taking place in the area of electronic imaging. There's hardly a day that doesn't bring word of a new digital camera or camcorder, a new large-screen display technology, a new printer or scanner, a development in image compression/storage/transmission, or whatever...

Some of these developments are only in the 'coming in the next year or so' category, of course, but others are well and truly under way. Even this issue of *EA* itself provides plenty of illustrations.

For example starting on page 10 you'll find Louis Challis' review of the Panasonic NV-DX1EN, one of the 'new breed' of digital camcorders offering what is virtually broadcast quality video — for less than $6000. Then on page 30 you'll find my review of the new Polaroid SprintScan 35 Plus desktop scanner, an amazing little unit which manages to scrape just about as much image information from a 35mm transparency as anyone could wish, and for a price about 1/15th that of the cheapest drum scanner. Our production editor Vitek Budzynski was so impressed by its performance that he 'borrowed' it to do many of the scans in the rest of the issue!

In our What's New section starting overleaf, you'll find news about some other imaging developments from NEC — including the Silicon View, a handheld 'no moving parts' digital AV viewer using PC-card storage. It only stores about four minutes of MPEG video and audio at present, but it could well be the personal video player of the future. There's also a bit on NEC's 42" plasma display screen; I saw one of these demonstrated at NEC's Multimedia Showcase, and the image quality was superb.

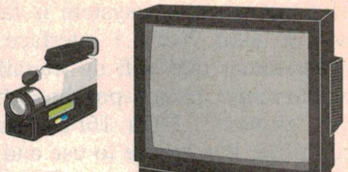
By the way, the photo of NEC's new Eco-PC at the bottom of page 6 was sent to us as an e-mail attachment file, directly from NEC's design lab in Japan. And you probably won't be surprised to learn that Tom Moffat sent us the pictures in his Madhouse column (pages 36-37) from the USA in the same way, having taken them with his trusty Epson PhotoPC digital camera.

And speaking of digital cameras, new and improved models continue to arrive at an ever-increasing pace. On page 7 you'll find brief details of HP's new entry, the PhotoSmart camera. I've also just learned that Sony has now released *two* new models, one offering a built-in 12:1 zoom lens and SCSI interfacing. We'll try to tell you more about it next month.

DVD discs and players at last look like becoming available here before the end of the year, too. So one way and another, 1997 really is shaping up as the year when electronic imaging technology finally 'bursts into bloom'.

Jim Rowe

WHAT'S NEW



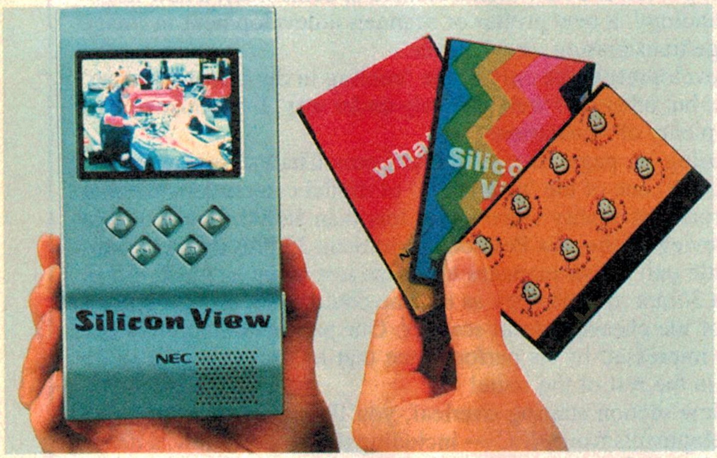
IN THE EVER-CHANGING WORLD OF ELECTRONICS

NEC previews its future products

In a recent Multimedia Showcase reported to cost $1 million, NEC Australia unveiled to the press and industry representatives over 60 prototype products which are expected to change the way we live, learn and work.

On a huge revolving stage, NEC presented the four worlds of multimedia — multimedia for business, for the community, for education and for the home.

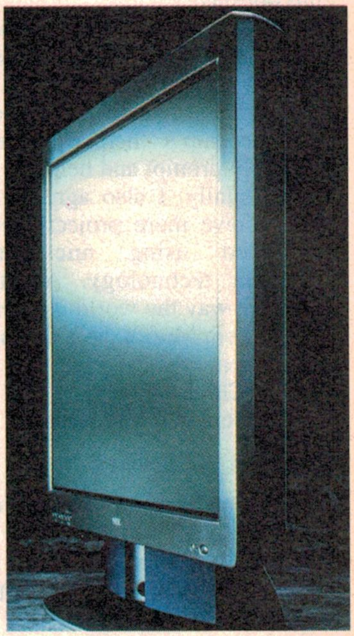
Among the advanced prototypes unveiled was **Silicon View**, an innovative 'no moving parts' full-colour video and music player which is so light and compact (295g with battery) it can be held in the hand and carried comfortably in the pocket. The unit provides real-time playback from MPEG compressed digital video and audio stored on a credit-card sized flash memory card, using LSI technologies developed by NEC, and provides VCR quality images and compact disc quality sound.



Using currently available flash memory PC cards, Silicon View can only store about four minutes of video and audio, but this is expected to increase as higher-capacity memory cards become available. A similar audio-only product has also been developed, offering CD quality combined with 'no moving parts' reliability and immunity to shock or vibration.

Another product displayed was a **Plasma Display Panel (PDP) TV**, only millimetres thick and representing the likely future of domestic TV receivers. Plasma display technology provides a bright, readable image, gives an excellent picture when viewed from virtually any angle, has no distortion or colour convergence errors and no magnetic field emissions. NEC claims to be the first company to offer a 42" colour PDP TV, and is predicting that wall-hanging TVs will be in every Australian home by 2010.

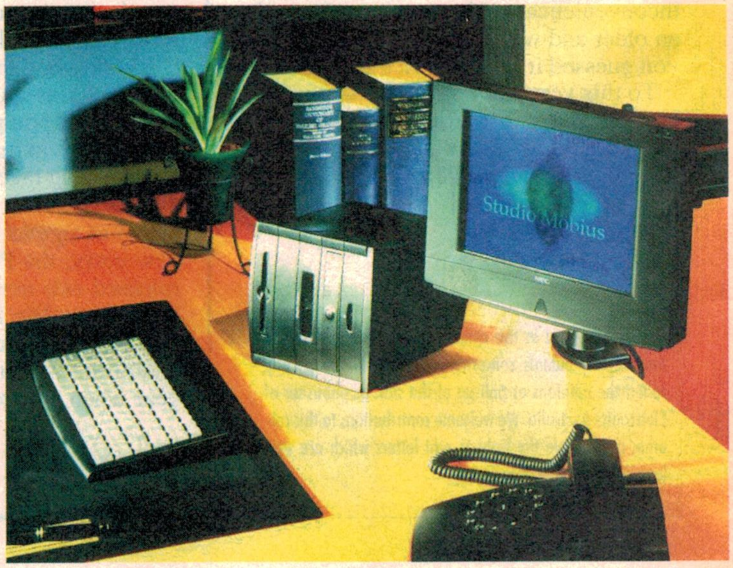
Also displayed were prototypes of NEC's **Eco-PC**, claimed as the first PC in the world designed without screws. Designed by using energy-efficient electronics and recyclable plastics and resins, this environmentally-sound PC is also modular and 'clip together', and can be easily disassembled for recycling of parts. The Eco-PC has a metal keyboard and does not use cables — radio signals are sent from the keyboard to the PC. The LCD display is 'naked' and supported by the stereo speakers. The Eco-PC was designed by NEC's Studio Mobius ecology-based corporate design division in Kanagawa, Japan.



NEC also demonstrated its **Personal Handy Phone System** (PHS), which it claims is the most technically advanced mobile phone system in the world. PHS combines both digital micro cellular and cordless technology to provide affordable, high quality communications for the mass market.

With PHS, you have the same handset phone for use at home and outside — all on the same phone number. You can select whether to use the mobile or your home service for your calls, thereby saving in call charges. PHS handsets are smaller than conventional mobiles and about half the weight. Another advantage is the lithium-ion batteries, which give about 500 hours of use in between recharging.

PHS has sold like hot cakes in Japan, with six million units sold in the first six months. NEC Australia has been actively involved in promoting PHS to Austel and the SMA, and an Austel Standard



is currently being finalised. NEC expects to launch PHS in Australia later this year.

A further display that attracted interest was NEC's **FishClub**, a 'virtual aquarium' made by combining a 32" HDTV monitor with a MUSE-encoded laserdisc player. A water-filled tank in front of the screen has air injected to provide a continuous stream of bubbles, achieving a high degree of realism. Watching colourful fish in a tank is a known stress reliever, and as NEC says, FishClub allows you to get the benefits without the chores of cleaning the tank and feeding the fish. An extensive laserdisc library is available with a choice of many rare salt water and fresh water fish. It isn't cheap, but might be worth considering for medical centre waiting rooms.

Software package teaches basic circuits

DesignSoft's new Edison software package allows students and other newcomers to learn the basics of electricity and circuit operation — safely, easily and enjoyably — by connecting up 'experiments' on screen, using 3D images of components like batteries, lamps, motors, resistors, switches, meters and so on.

The package faithfully but safely simulates what would actually happen with physical components. For example depending on the applied voltage, a lamp will glow faintly or brightly, or even 'explode' if seriously overloaded. Similarly motors or resistors will 'burn', and a horn will sound while the program shows clearly the overload current path.

Students can make up their own circuits, or select from 27 informative experiments included with the program. You can also practice troubleshooting by solving more than 100 sample test problems.

Edison runs on 386 or higher PCs, under Windows 3.1. It needs 2MB of hard disk space, 4MB minimum RAM and VGA or EGA graphics.

For further information circle 142 on the reader service card or contact distributor TTS Training & Technical Supplies, PO Box 289, Ingleburn 2565; phone (02) 9829 2893 or fax (02) 9829 1296.

HP releases a digital camera in USA

Hewlett-Packard has joined the rapidly emerging digital camera market with its new HP PhotoSmart Digital Camera, which joins the company's existing range of scanners and printers. The new camera provides 640 x 480 pixel 24-bit image resolution, enhanced with HP's PhotoSmart technology.

The camera sports a 6mm f/2.8 seven-element glass lens and has continuous autofocussing between 65mm and infinity. It uses PC memory cards (PCMCIA cards) for image storage, using JPEG compression at three different quality levels. As many as 32 images can be stored on the 2MB memory card supplied with the camera at Normal quality, dropping to 16 images at Fine level and four images at Superfine level.

Other features of the camera include automatic exposure, a three-mode electronic flash, a self-timer and fast image transfer to a PC via an RS-232C serial interface. The camera comes with HP's Photo Acquisition software and also Microsoft's PictureIt! package, designed for use on systems running Windows 95 and TWAIN-compliant applications.

The HP PhotoSmart Digital Camera measures 153 x 85.5 x 64mm and weighs 550 grams. Powered by four AA alkaline cells or an optional AC adaptor, it's selling in the USA for around $1400. When it will be available out here is not known at the time of writing.

New VCR is easy to operate

Panasonic has launched a new simple-to-operate two head video cassette recorder called the NV-SD270, offering a novel feature which Panasonic calls 'Intro-Jet Scan'.

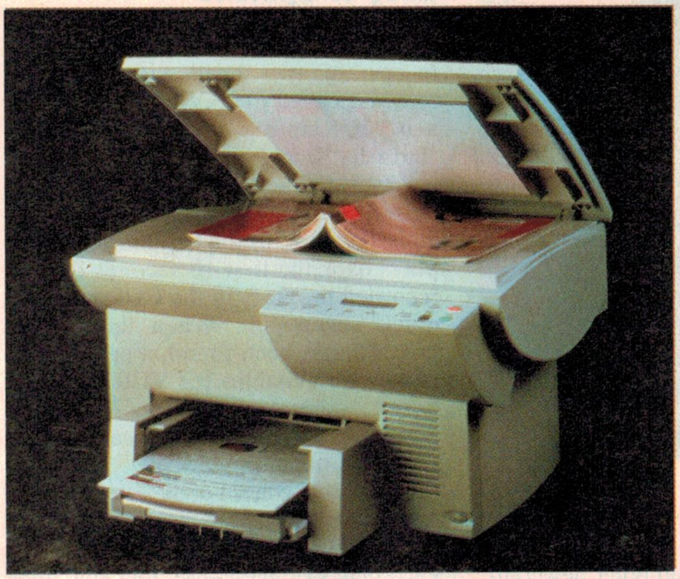
When the user presses the Search button on the VCR, the tape is immediately rewound to the beginning. It then plays back the first 10 seconds of each recorded program in the CUE mode, in quick succession. When the desired program has been found, a press of the play button enables the VCR to switch over to normal play mode. This function is also convenient for cataloguing a video collection.

The remote control of the NV-SD270 is compatible with 12 popular brands of television. The remote also includes Panasonic's simple-to-use 'four key' timer programming which enables the user to record their favourite programs by using individual keys for channel, date, start time and stop time. G-Code programming is also included.

The new NV-SD270 is also compatible with colour TV systems used overseas, so if the user receives a tape from countries like the USA and Japan the VCR will play back the cassette on both PAL and NTSC TVs. It is also able to record in NTSC 3.58 format, so users can record and send a tape overseas.

The VCR's tuner is preset in the factory for all Australian free-to-air television stations, to make it very easy to start using straight out the box. On-screen display on the TV screen is claimed to make the recorder easy to operate and program.

The Panasonic NV-SD270 is available from leading electrical retailers for an RRP of $449. For further information contact Panasonic's Customer Care Centre on 132 600.



HP's new colour Printer-Copier-Scanner

Hewlett-Packard has built on its expertise in the colour-inkjet printer and scanner markets by developing and introducing the new HP Office Jet Pro 1150C colour printer-copier-scanner, intended for small businesses, professional home-office users and corporate telecommuters.

The 1150C is designed to deliver state-of-the-art colour inkjet printing, colour copying and colour flatbed scanning, and is claimed to make it easy for users to produce 'no compromise' colour materials in-house rather than relying on expensive outside service bureaus. It's expected to sell in Australia for about $1699 including tax.

HP says that the 1150C delivers 'best-in-class' performance as an inkjet printer, copier and scanner. The new all-in-one device prints crisp black text at speeds up to 8 pages per minute (ppm), mixed text and colour documents at speeds up to 4ppm, copies monochrome documents at speeds up to 7 copies per minute (cpm) and colour documents at speeds up to 3cpm. It can scan a colour image into an existing document in less than a minute.

The 1150C also incorporates up to 1200 dots-per-inch (dpi) enhanced, 24-bit colour scanning. Customers can scan colour and grayscale documents with precision and speed and then edit those images. Customized scanned images then can be easily incorporated into proposals and business plans, marketing materials and presentations.

The 1150C comes with a suite of HP-developed 'smart' technologies claimed to make complete colour document management easy. These include ColorSmart colour-management software; CopySmart, which automates digital copying; FontSmart, which simplifies font management; and ScanSmart, which makes acquiring text and colour images as easy as printing. It also comes with Adobe PhotoDeluxe, a simple yet powerful tool for editing and managing scanned images, and Caere OmniPage LE optical character recognition (OCR) software, which recognizes printed text and converts it to electronic form.

Interestingly, the 1150C hooks up to the user's computer via a bidirectional parallel port, for minimum hassle and high speed. The software is optimized for use with Microsoft Windows 95 and is compatible with 3.1 and DOS operating environments.

For further info call HP's Australia-wide service line on 131347, or look on the Web at **http://www.hp.com./go/officejet-pro**.

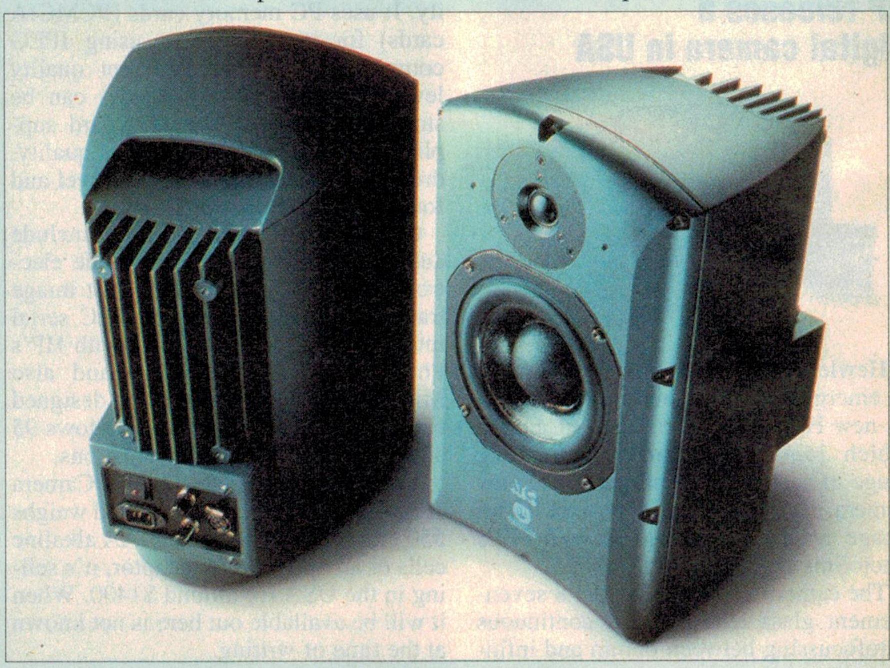
Active studio monitor speakers

Speaker manufacturer ATC has introduced what it claims is a 'revolutionary' new model based on its award winning SCM20 7" two-way nearfield studio monitor. The SCM20A PRO is a powered active configuration, incorporating ATC's new Super Linear magnet structure drivers in an aircraft alloy enclosure. ATC claims it's the 'ultimate' transportable monitor system.

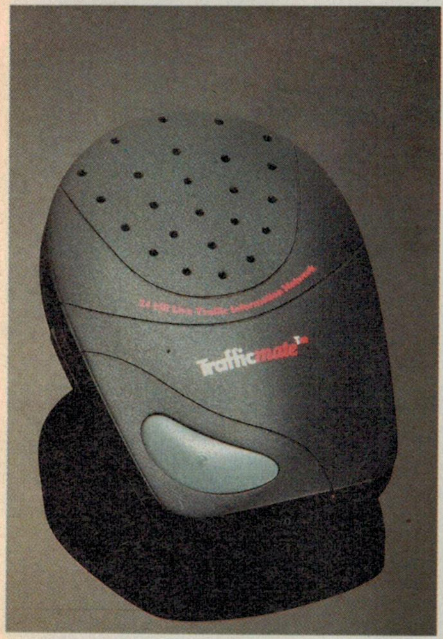
The aircraft alloy construction enables the cabinet to be braced more rigorously than cabinets manufactured with conventional materials, as well as providing cooling fins for the inbuilt amplifiers, a carrying handle and Omnimount inserts. A 250W amplifier drives the mid/bass transducer with a 50W unit for the 1" soft dome tweeter.

An LF contour control provides bass boost options for room equalisation as well as a flat reference setting. A switchable integral power supply can accommodate 230V, 110V or 100V AC, giving the SCM20A PRO true plug-and-play operation anywhere in the world. The SCM20A PRO isn't cheap, though; it's expected to have a RRP of around $9000/pair.

For further information circle 140 on the reader service card or contact A.R. Audio Engineering, of 558 Darling Street, Balmain 2041; phone (02) 9810 5300.



Unit tells car's driver of conditions



As the road system in the UK gets more and more congested, British firm Trafficmaster has produced an innovative product designed to make life easier for the frustrated motorist.

The 'Trafficmaster Freeway' is a low profile voice-based unit that sits on the car dashboard with all functions accessible through a single key. This gives the driver real-time information about his journey for a distance of 10 miles ahead on the motorway system or on major trunk roads.

Information on traffic flow is gathered from a network of over 2400 infra-red sensors, which monitor the speed of traffic passing below. When the speed drops below 30mph for an average of three minutes, the sensors alert the Trafficmaster National Date Centre in Milton Keynes, which continually sends information to over 1500 transmitter stations.

This is the third in-car product developed for Trafficmaster by product design consultants London Associates. The first screen-based system covered a pilot project working on a 25-mile radius around London; the success of this led to a second product, the YQ, launched when the system went nationwide a few years ago.

The design of in-car information systems involves very careful consideration of safety issues, as well as the appearance which must fit comfortably in a variety of automotive interiors.

The Freeway is designed for simple DIY installation and does not involve any wiring. Messages are speech-based and the driver can control the information by switching between manual and automatic modes. The use of 3D CAD modeling and rapid product development techniques were essential to the success of the product, which was launched through major electronic retail outlets before Christmas.

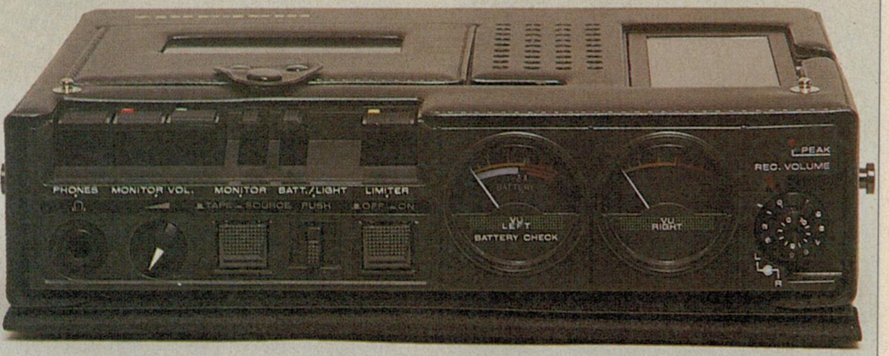
Stereo recorder has three heads

Marantz Professional have released a new top of the line portable cassette recorder, the CP430N. This new model is a stereo three-head version of the industry standard PMD222, and includes a number of additional recording and monitoring factilities including two illuminated VU Meters, Dolby B and dbx noise reduction, MPX filter and bias fine adjustment.

The CP430N has a built-in speaker, two 6.5mm phono mic inputs with mono mode facility, +/-6% pitch control, headphone output, peak indicator, memory rewind and RCA line in/out. A rechargable battery pack offering five hours of continuous operation is optionally available. The CP430N automatically recharges the battery pack when connected to mains voltage via the plug pack.

The CP430N is supplied complete with a protective Carry Case, Shoulder Strap and Mains Power Pack and has an RRP of $1595.

For further information circle 141 on the reader service card or contact A.R. Audio Engineering of 558 Darling Street, Balmain 2041; phone (02) 9810 5300.



Compact video & TV combo

Panasonic has added a 34cm 'televideo' to its television range, combining a TV and VCR in one unit. Panasonic has been successfully marketing a 51cm televideo for a number of years.

The built-in VCR in the new model is a two head machine which includes G-Code programming and on-screen display. The unit has a 34cm dark tinted flat screen and includes automatic electronic tuning and manual search options.

Other features include a headphone socket for private listening and an AV input and output to connect other audio or visual equipment and video games machines.

The Panasonic TC-14SV10A has a single remote control to operate the TV and VCR functions and includes both PAL and NTSC playback. It's available from leading electrical retailers for an RRP of $1099. For further information contact Panasonic's Customer Care Centre on 132 600. ❖

PANASONIC'S NV-DX1EN 'DIGITAL6' CAMCORDER

This month our reviewer Louis Challis had the opportunity to evaluate one of the new Panasonic NV-DX1EN digital camcorders — and very impressive it turned out to be. Offering a large multi-angle colour electronic viewfinder and full CD-quality stereo audio recording, in addition to studio-quality digital video recording, it's an outstanding example of what we can expect from future digital camcorders.

The last 30 years has seen some truly dramatic changes in the nature of home video recording hardware. During the earliest stage of that period, I used 8mm and then 'Super 8' film cameras. The film era was closely followed by battery operated video cameras and recorders, firstly Beta and then VHS. The change from film to video formats was by no means as smooth, nor as comfortable as I might have liked. The early generation of video recorders were unreasonably large and heavy, which detracted from their otherwise obvious attributes.

Five years ago, with the switch to 8mm and Hi-8 video, we all revelled in the flexible lightweight Handicams, which the amateur recording market accepted immediately.

Of course the Hi-8 and VHS-C formats with which we are now familiar employ analog recording systems. Whilst the quality of the sound recorded by those systems has slowly and inexorably improved, the analog based video technology imposes practical limits to further major advances in technical performance.

Further progress would appear to be dependent on the adoption of digital recording technology. Inevitably that would also lead to significant increases in both the technical complexity and thus the cost of the new (or superior) systems.

Whilst you may consider that your existing 8mm or VHS-C camcorders are good enough, or that they satisfy your current requirements, there are significant number of users who have expressed a dissenting view. If you've had the good fortune to view the recordings produced by a professional digital video camera, you will be aware of the superiority of its video and audio recordings compared with the previous generation of analog-based equipment.

These days, the 'winds of change' tend to blow very strongly in the consumer market.

New format: DV

Perhaps few readers would be aware that two years ago, 56 of the world's major hardware and peripheral equipment manufacturers quietly signed an industry agreement adopting a new consumer based digital video recording format. At the heart of the new system is a minuscule 'Mini DV' video cassette, with external dimensions of only 66 x 48 x 12.2mm.

The 'Mini DV' video cassettes are currently marketed with 30-minute or 60-minute recording lengths. With a video camera or camcorder, it is now possible to produce video recordings on which you can wax lyrical on your technical ability — or should you prefer, on the quality of the recordings of your favourite subject.

The first generation of digital video camcorders were released at the Winter Consumer Electronics Show in Las Vegas, in January 1995. I was present at the release, and at the time wrote how impressed I was by what I saw, and of my impressions of the performance demonstrations.

The picture line resolution, colour quality and overall functional advantages of the medium were so far in advance of the systems to which we had then become accustomed, that I realised that the analog video recording systems were approaching the end of their road. I observed a dramatic improvement in the visual quality, and as I listened to the audio I was impressed by its CD quality. The sound quality displayed a dynamic range which was well beyond the capabilities of an analog system.

As impressive as the first generation of digital video Handicams may have been,

their price was equally daunting.

In the year following the release of the first generation of digital camcorders, the second generation arrived, and that genre is typified by the Panasonic NV-DX1EN.

Panasonic's Digital6

When Panasonic Australia recently offered *EA* one of the first of its NV-DX1EN cameras to review, we immediately accepted. On opening its large cardboard package, and before I had time to examine it in detail, I was impressed by what I perceived to be its visual simplicity. Of course, first appearances are frequently deceptive, and my initial perception did indeed prove to be wrong.

The NV-DX1EN, which Panasonic describe as their 'Digital6' system, has a multitude of outstanding features. The first of those features is its adoption of three separate 1/3" (8mm) diameter Charge Coupled Devices (CCD) for the image chips. These chips separate out the three primary colours of red, green and blue in the digital encoding process.

The mechanism by which the colour separation takes place is ingenious, and uses a clever invention which is described as a 'gapless (dichroic) prism'. The dichroic prism accurately splits the incoming light beam into its primary colours, and directs each of those beams into a separate CCD image chip.

Now each of those CCD chips incorporates over 100,000 separate pixels. With three separate arrays as large as that, the system is capable of providing an unusually high signal-to-noise ratio, supplemented by an exceptional sensitivity and an outstanding dynamic range.

The designers of the 'Digital6' have offset the axis of each of the CCD chips by half an element in the horizontal axis plane. This simultaneously minimises and compensates for the gap between individual pixels in each of the adjacent CCD chips, achieving a perceptible improvement in overall optical resolution.

Panasonic NV-DX1EN Digital Camcorder

A digital camera and recorder using the Digital Video SD format, and Mini-DV video cassettes. Overall dimensions 267 x 144 x 121mm (L x W x H), weight 1.3kg incl. battery.
Camera: Uses three 1/3" CCD image sensors, coupled to an f/1.6 10:1 variable speed zoom lens (6 - 60mm). Digital zoom function gives effective 20:1 range. Digital image stabiliser. Effective RGB resolution 480,000 pixels. Minimum illumination 4 lux.
Viewfinder: Uses a 0.7" colour LCD, with magnifying eyepiece (adjustable focus, brightness). Viewfinder can be rotated through 10 different angles for convenient shooting.
Recorder: Provides virtually broadcast-quality 500 line resolution video recording (13.5MHz/8-bit sampling). Digital PCM stereo audio can be recorded at either 48kHz/16 bits, or 32kHz/12 bits.
RRP: $5599.
Further Information: Panasonic Australia's Customer Care Centre, on 13 2600.

Panasonic claims that this stratagem achieves a resolution equivalent to the camera having 480,000 pixels!

The 'Digital6' recording format employs a 625-line, 50 field PAL colour signal. This of course matches the video input characteristics of your existing TV set or monitor. By contrast, the audio signal may be recorded as either a two channel 16-bit 48kHz PCM signal with a 20kHz bandwidth and a 90dB dynamic range, or should you require, a four channel 12-bit 32kHz PCM signal with a 13kHz bandwidth and a nominal 70dB dynamic range.

By adopting an advanced digital compression technology, and an equally impressive 500-line resolution capability, the video signal achieves broadcast quality. That constitutes a significant improvement over that achieved by either a S-VHS based system, or a Hi-8 format camcorder.

The video signal is recorded using a 13.5MHz sampling frequency in conjunction with an 8-bit processed digital luminance signal. As I quickly discovered, the resolution of the recorded optical signal is absolutely stunning. When played through a high quality professional monitor, or through a new generation of wide screen high resolution 'home theatre' TVs like the Samsung Model CS-721 APF 'Worlds Best Plus' 29" + 1" TV set, the picture quality is absolutely superb.

Unlike the analog formats to which many of us had become reconciled, the 'Digital6' achieves a visibly superior colour fidelity, supplemented by an almost total absence of cross-colour distortion. Using a Panasonic colour test chart I could detect traces of colour smear at the interface between the primary red and blue test patterns, but not between the blue and green, or red and green.

Panasonic claims that its 8-bit processing format achieves a 54dB luminance signal-to-noise ratio. Based on my previous evaluation of the S-VHS and Hi-8 formats, and my evaluation of test patterns with a Sony Profeel monitor connected to the analog output, it would appear that the claim is justified.

Deceptively simple

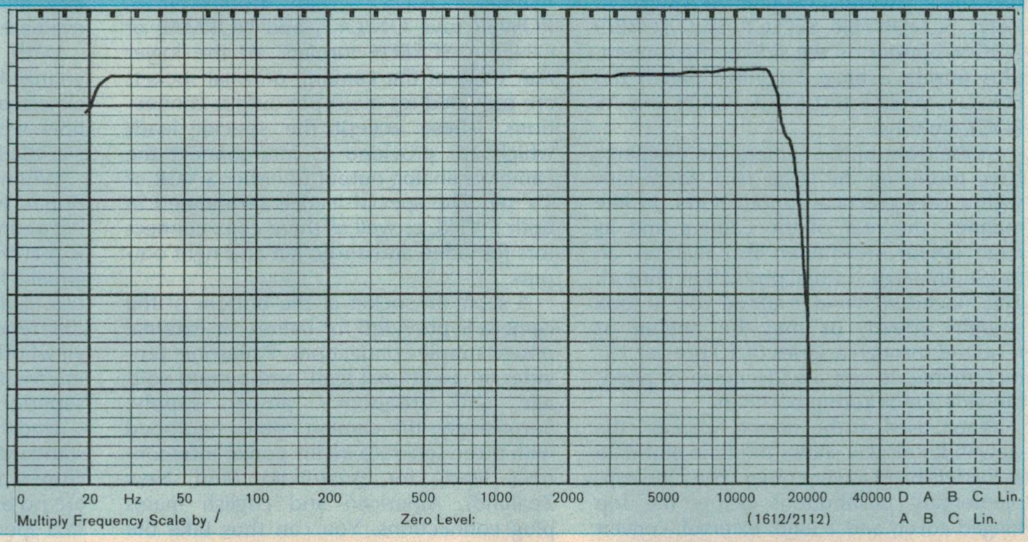
The external appearance of the 'Digital6' camera is deceptively simple. At first glance one could be forgiven for drawing the conclusion that there are relatively few controls.

Indeed, on first examination it appeared that those controls were limited to the conventional power ON/OFF button with a central red RECORD button, the ZOOM control toggle bar, a pushbutton for selecting VCR or CAMERA, and a camera SEARCH button with the adjacent PHOTO SHOT button.

From a basic amateur's standpoint, those are the only primary controls which

PANASONIC N-DX1EN CAMCORDER — RECORD TO REPLAY FREQUENCY RESPONSE (12-BIT MODE)

The record-replay audio frequency response of the NV-DX1EN, in 32kHz/12-bit sampling mode. It's within +0.5dB and -3dB from 20kHz to 15.5kHz. The 48kHz/16-bit mode is effectively flat to 20kHz...



you are likely to use for more than 90% of your video recording. Indeed, I handed the camera to a 13 year old relative, and he proceeded to produce a good video recording, with only a portion of those controls being used.

On closer examination, and following my discovery of the hinged cover at the top of the camera which provides access to a range of additional switches and controls, (and to the battery and video cassette compartment), I found that there were an additional nine pushbuttons in a neat linear array. Those nine pushbuttons provide an adjunct to the large and high definition internal colour electronic viewfinder, to activate a multitude of additional functions.

When activated, the viewfinder indicates the battery condition and shows the counter time in hours, minutes, seconds and the number of frames. It also shows whether the camera is in pause or record mode. Those functions are further briefly emphasised by the projection of a large red 'RECORD' or green 'PAUSE' in the middle of the screen.

On activating the button labelled menu, the display shows whether:

- The digital zoom is ON or OFF
- Audio recording is in the 12-bit or 16-bit mode.
- The scene index is in two-hour or DAY format.
- The remote control has been selected for a VCR-1, VCR-2 or OFF.
- The recording lamp at the front of the camera is ON or OFF.
- The recording mode is normal or OFF.
- The clock display in the lower left-hand corner is set to ON or OFF.

As important as those functions may be, once set, there is generally minimal or no need to reset them during subsequent recording or replay sequences.

There are of course other useful, but infrequently used functional controls. These include the MANUAL/AUTO recording switch, IMAGE STABILISER, FADE, COUNTER SELECT and TURBO ZOOM buttons on the side of the camera, plus (inside a hinged control panel) the FOCUS, WHITE BALANCE, GAIN and AE LOCK buttons.

At the front of the camera the designers have protected the large 10:1 zoom lens with a very practical rubber hood. In like manner, the rear of the camera and its large colour viewfinder also features an unusually large rubber protection shroud. The hinged viewfinder allows you to look straight ahead, or may be angled as required through a series of 10 pre-set 15° increments, to suit a wide range of possible video monitoring positions.

When used in the normal manner, the viewfinder display shows the time and date at the left-hand lower corner. The nine supplementary pushbuttons below the top hinged cover, and a tenth external, convert

On the right-hand side, looking from the rear, the top flips up to reveal the VCR controls. Pressing the eject button opens the side, revealing the battery compartment and cassette well.

the camera to a VCR. The other nine switches then perform all the standard VCR functions, supplemented by a DUB INSERT, together with the extremely convenient BLANK SEARCH function. This facilitates the rapid detection of the end of your previously recorded material. It proves its value when having viewed your previously recorded material, you wish to return to recording without a break.

On closer examination, one also discovers additional buttons and controls for manual FOCUS, screen BRIGHTNESS, POWER save ON/OFF, and NORMAL or CINEMA SCREEN formats. At the lower rear edge of the camera, unusual sockets are provided for multi-pin output connections. These accept the special leads which are provided to interconnect the camera's analog output to either a VCR or TV set. The special lead is terminated in both S-VHS, as well as three coax connectors for video and audio left and right outputs.

A separate socket at the bottom of the camera is provided for battery or external power supply connections. Panasonic provides an additional lead, and a multi-voltage and frequency power supply. Surprisingly, the camera comes equipped with three separate mains power interconnect leads for Australian (and New Zealand), American and English mains plug connections. You can thus take the appropriate leads for your destination and charge your battery, or operate your camera as a VCR without complication.

Trying it out

Once I had familiarised myself with the fundamental controls, I sat down to examine the handbook — which has 172 pages written in English, Japanese, Russian and Arabic. Having examined the book, but prior to digesting all its contents, I decided to experiment with the video recording, and replaying those recordings to evaluate the camera's potential.

With a family function fortuitously arranged with a host of guests, I had an almost perfect opportunity to discover just how well the 'Digital6' camera fulfils its intended role.

When used in its simplest possible functional mode, the only real difference between the 'Digital6' and a Hi-8 camera, is that the 'Digital6' is slightly larger, marginally heavier, and somewhat easier to use. The most immediate and significant difference is the superior picture in the viewfinder, and the additional functional information — which is ergonomically superior in its presentation.

Under normal, average or even substandard prevailing light conditions, the camera functions superbly. Provided there are no extreme differential light conditions in a specific scene, the camera's automat-

ic iris setting and distance focusing functions behave in a faultless manner. Only when subjected to optical extremes, as typified by unusually bright or direct sunlight projecting through a window behind subjects whose faces are poorly illuminated, is there any need to resort to manual resetting of the iris control to maintain a professional video quality.

When replaying either directly through a monitor, or following video re-recording with a quality VHS VCR, one is immediately aware of the superlative video quality. I found this is also matched by its outstanding audio quality.

Quick audio test

Having confirmed the video quality, I decided to evaluate the audio quality using the special microphone and headphone sockets in conjunction with the normal dual channel audible output capability — afforded by the special cable provided with the camera. As I soon discovered the 12-bit mode produces a record-to-replay signal, with a genuine 15kHz bandwidth which was within +0.5 and -3dB from 20Hz to 15.5kHz. The 16-bit mode produces a response which is effectively flat from below 20Hz to 20kHz.

When you are using the camera's own built-in top mounted pair of stereo microphones, there is little point in selecting the 16-bit recording mode. That's because the built-in microphones lack adequate bandwidth. If external professional microphones are used however, then there is a justification for switching to the 16-bit mode.

The 'as-recorded' digital signals contain the time and date information encoded within the composite digital signal. When recording (or on replay), that information can be encoded or hidden at will.

Whilst the NV-DX1EN is nominally optimised for amateur use, the designers have integrated a special five-pin miniature socket on the camera's rear panel. That socket provides access to the complex digital signal, facilitating editing, and/or re-recording with no reduction in dynamic range or signal quality. Panasonic is apparently developing the associated hardware, with integrated software for reprocessing the digital signals.

Summarising

With an RRP of $5599, the 'Digital6' is by no means inexpensive. But price is one parameter and performance is an equally important one. This camera provides a performance which is so far in advance of that to which you (and I) have become reconciled, that it now sets the standard by which other video cameras will be judged.

The Panasonic NV-DX1EN 'Digital6' provides the serious amateur, or more pointedly the disenchanted professional, with a markedly smaller and lighter system whose technical and functional performance is outstanding.

Once you have viewed what this unit can achieve, you may well come to the same conclusion that I have: namely, that it is indeed worth the money. ❖

MEET INDIA'S 'MR SATELLITE TV'

With over 30 years of experience in long-distance ('DX') and satellite reception of television signals, Bindu Padaki has earned himself a world-wide reputation as India's 'Mr Satellite TV'. Here's what travel writer and radio amateur Tom King found when he paid Padaki a visit recently at his home in Bangalore.

by THOMAS E. KING

On a hot day in the Madras of the early 1970s, Bindu Padaki sat before a black and white TV set not believing what he was seeing. The picture wasn't very stable, but as it faded in and out he could just distinguish that the signal was coming from Calcutta, some 1300km away to the northeast.

How was it possible, he wondered, that he could receive a TV signal from so far away? No one he knew could provide any explanation. Intense curiosity prevailed, so for answers he went to the British Consulate Library in Madras.

From his home in Bangalore, Bindu Padaki can view more than 100 channels from more than two dozen different satellites, using this 3.5-metre parabolic dish antenna.

He found that long distance or 'DX' reception of TV signals was an infrequent but not uncommon phenomenon, caused by signals being reflected by — rather than passing through — layers of ionised gas.

Additional reading stimulated him to try and tune in to even more terrestrial TV DX. Broadcasts from Bangladesh, Sri Lanka, Karachi, Bangkok and even stations from the Gulf countries were sporadically seen and dutifully logged over the next few years by this keen DXer, using a simple but rotatable TV antenna and a conventional TV set.

Patience and a fair bit of luck, coupled with suitable weather conditions were the keys to seeing signals that nobody else even knew were there, noted Padaki.

The middle of the 1970s brought a new challenge when the internationally renowned TV DX hobbyist in the United Kingdom, Roger Binney, wrote to Padaki saying "The Soviets have launched a telecoms satellite and you may be able to see TV transmissions in South India".

"I was intrigued", recalled Padaki, who immediately went out and constructed a high gain, very directional TV antenna from two sections of plastic pipe and coat hangers cut to specific lengths.

For his investment of 25 Rupees (about A$1), the experimenter got 'very strong signals' from *Ekran*, the first of an ongoing series of telecoms satellites launched by Soviet scientists.

The only complication was that the images were reversed; positive was negative and vice-versa. Somehow he had to get a device to change the polarity of the incoming signals.

At the time, the Indian government was devoted to an experimental project that involved transmitting educational TV programmes via satellite to dish-equipped remote villages.

Built from a dollar's worth of plastic pipe and coat hangers, Bindu Padaki used these homemade antennas to view his first satellite TV signals more than 20 years ago.

Padaki learned of this and immediately booked on a train for the long trip to Ahmedabad, north of Bombay.

The experts at Ahmedabad had the device; Padaki had the antenna. Combining the two and connecting them to suitable receiving equipment produced excellent quality pictures of ballet and concerts. "The only problem was everything was in Russian!", said Padaki.

The year 1982 brought the Asian Games to India and with this headlining event, the advent of colour TV. Padaki was enthused by both, because he could watch a multitude of interesting programmes at any time of the night or day.

"The initial purchase of a colour TV and then, in 1987 of a multisystem colour TV, was considerable," said Padaki. "I didn't want to divert money intended for household expenditures on my hobby, so I started writing about satellite TV", he said.

This along with royalties earned from books on movies and videos is the major source of income for the now-retired Padaki, who lives with his wife and family in Bangalore.

Not only does the 30-year veteran DXer — one of only about 50 dedicated hobbyists in 950 million-strong India — regularly write on satellite TV topics for Indian and overseas publications, but these days he is regularly contacted by service providers because of his wealth of knowledge.

"Not long ago I received a call from an international satellite broadcaster. The company had just leased a transponder on a well known satellite and had commenced test transmissions. But as the officials didn't have a suitable receiving setup, senior executives came over to my house to evaluate the quality of their signals over South India", he said.

Equipment at the Bindu Padaki 'satellite TV headquarters' includes a JVC/Onida 29in multisystem colour TV, a Weinersat 912 satellite receiver fed with RG-6 coax cable from a Bangalore-made 3.5-metre C band parabolic dish antenna, fitted with a Chaparral feedhorn and a Gardiner 20K LNB (low-noise block downconverter).

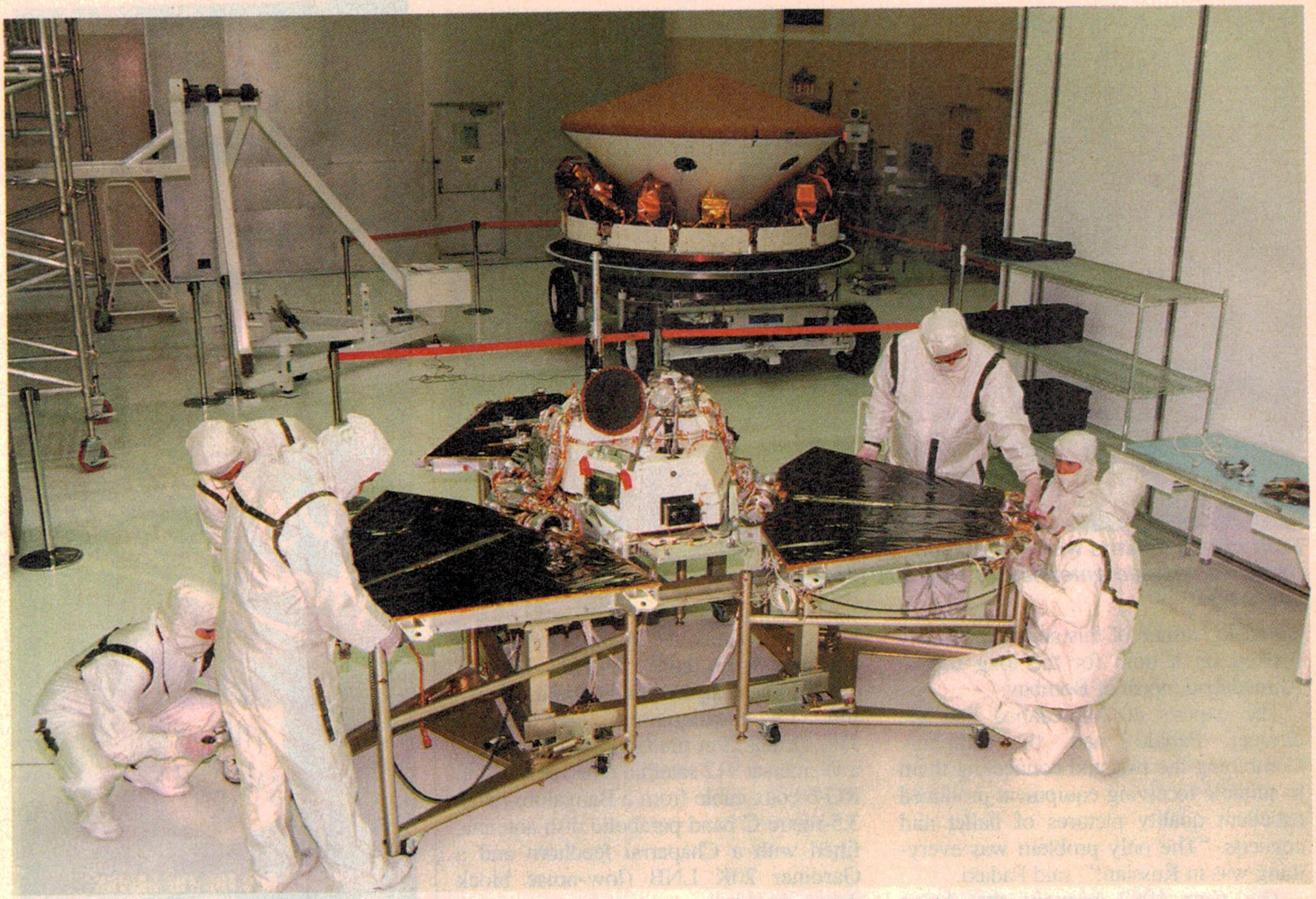
The only thing that is not state-of-the-art is the motor on the dish antenna — there isn't one. Despite this Padaki, can direct the antenna by hand to one of the 25 or so satellites that have a footprint over India, in less than 15 seconds with a deft swing of the counterbalanced parabolic dish.

Colour coded notches speed the process. Red markers denote Russian satellites, while blue ones signify English language satellites. Green is for Arabic language satellites and yellow marks Chinese language satellites.

From 31°E, the orbital slot for Arabsat, to 142.5°E where the Russian Rimsat G2 is parked, Padaki has a horizon full of satellites which give him more than 100 different viewing choices.

"These are just the ones I can see with my present setup. I know there are more channels available, but don't yet have the necessary equipment. With it I'm certain there are at least another 100 channels to be seen and that's not including future channels on all the new satellites which will be launched in 1997 and later years", he added.

"That's one of the fascinations of this absorbing hobby", he said. "Wait a month and there will be something new coming from the sky." ❖



PATHFINDER'S COMING SOJOURN ON MARS

In a few weeks' time, NASA's Pathfinder mission should be landing on the surface of Mars and releasing Sojourner — a very compact six-wheeled rover destined to become the first autonomous vehicle to explore the surface of another planet. Here's the background to Mars Pathfinder, which is the first of NASA's new low-budget Discovery missions.

by KATE DOOLAN

One of the most talked about areas of space flight is the large sum of money that it costs to launch anything — especially planetary probes, which can run into billions of dollars over the life of a project. Whilst expensive, this still doesn't compare to the costs of military aircraft that are currently in use by many countries.

If a planetary spacecraft is not successful, critics always bring up the cost of the spacecraft and question whether value for money is being obtained.

In 1992, newly appointed National Aeronautics and Space Administration (NASA) boss Dan Goldin was listening to this kind of criticism and came up with the idea of the 'Discovery' program, which would build 'better, faster and cheaper' spacecraft and then launch them for under $150 million dollars. Although this criterion could apply to any of NASA's many varied programs, planetary spacecraft were specifically targeted.

One of the first spacecraft in this new program is the Mars Pathfinder. Launched last December, it is scheduled to reach its destination on the 4th of July 1997, and will be demonstrating a series of new technologies that in time are likely to be a feature of most planetary spacecraft. The Mars Pathfinder was developed and designed to demonstrate an innovative approach to landing a spacecraft and rover on the Martian surface, after diving through the atmosphere.

Landing on Mars will be nothing new for NASA. On 20 July 1976, Viking 1 landed on the Chryse Planitia and before it was shut down in November 1982, the lander had transmitted 2450 images of the Martian surface. Just six weeks after the first landing, Viking 2 landed on the Utopia Planitia on 3 September 1976 and returned 2170 images before been shut down in November 1980. The two orbiting spacecraft that delivered the landers to their final destinations also returned

51,500 images, as well as providing valuable scientific data.

Small and light

What *is* new is that the Mars Pathfinder spacecraft weighed only 890 kilograms at launch. This included the cruise stage, aeroshell and backshell, solar panels, propulsion stage, medium- and high-gain antennas plus 100kg of hydrazine cruise propellant. The cruise stage measured 2.65 metres in diameter and stood 1.5m tall. The lander, which resembles a pyramid, stands 0.9m tall with three triangular shaped sides and a base.

When the Mars Pathfinder arrives at its destination and is ready to enter the Martian atmosphere, its main components will be the aeroshell, folded lander, rover, parachute, airbag system and small rocket engines. All up the spacecraft will then weigh 570 kilograms.

Once it has landed on Mars and its air bags have been deflated, the spacecraft will weigh in at 360kg. Subsystems that contributed to its landing weight will include the opening/uprighting mechanism, lander cabling and electronics, rover and scientific instruments. When the spacecraft is finally upright and lying flat on the planet's surface, it will measure 2.75m in diameter and will feature a mast-mounted camera or 'stereo imager' that is 1.5m off the surface.

The lander is controlled by a control computer, the IBM RAD 6000 — a radiation-hardened single board computer that is commercially available back on Earth. The computer has a 32-bit architecture which executes more than 22 million instructions per second. The computer is used to store engineering and science data, including images and rover information, in 128 megabytes of available memory. As well, the flight software is stored in the unit.

During its flight to Mars, the spacecraft has required 178W of electrical power — provided by 2.5 square metres of gallium arsenide solar cells. Once the spacecraft has landed on the Martian surface, more solar cells will be exposed to the Sun than during the cruise and with the onboard batteries will provide between 850 watt-hours on clear days and 425W-h on days when the Sun is obscured by dust.

The lander has three solar panels, each with an area of 3.3 square metres and supplying 100W-h of power each day. At night, it will operate on rechargeable silver-zinc batteries with a capacity of 40A-h.

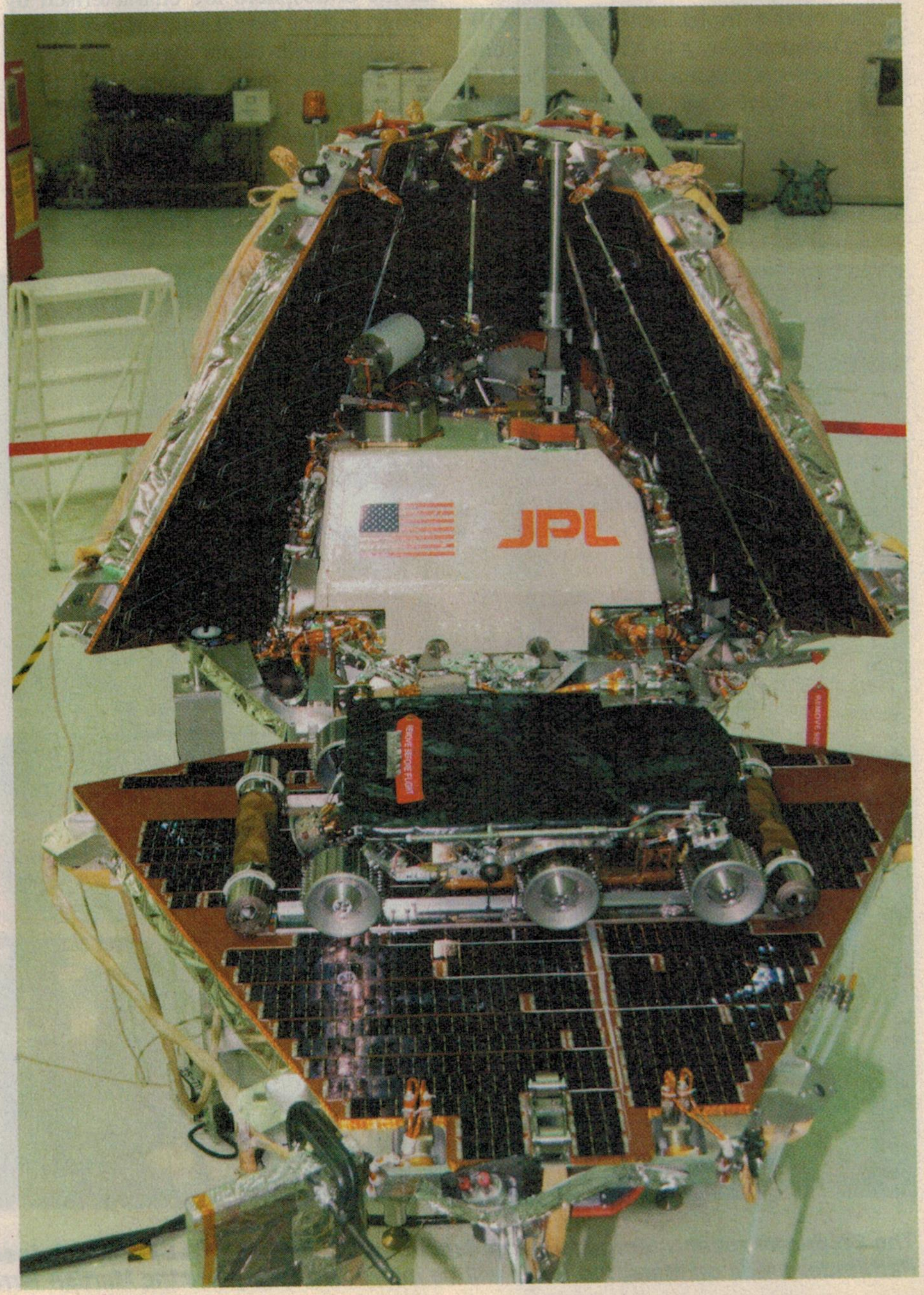
Stereo imager

The Imager for Mars Pathfinder (IMP) is a stereo imaging system with colour capability provided by a set of selectable filters for each of the two camera channels. The IMP consists of three physical subassemblies:

1. The camera head itself with stereo optics, filter wheel, charged coupled device (CCD) and preamp, mechanisms and stepper motors;
2. The extendable mast with electronic cabling; and
3. Three electronics cards which include CCD data card, power supply/motor drive card and interface card, which plug into slots in the integrated electronics module within the lander.

Azimuth and elevation drives for the camera head are provided by stepper motors, with a geared head providing a field of view of +/-180° in azimuth and from +83° to -72° in elevation, relative to the lander coordinates. The camera system is mounted at the top of a deployable mast which is a continuous longeron, open lattice type. When deployed the mast provides an elevation of 0.86 metres above the lander mounting surface.

At the camera's focal plane is the CCD sensor, mounted at the foci of two optical paths and bonded to a small printed



The Sojourner rover in folded position, mounted on one of the 'petals' of the lander module of the Mars Pathfinder and viewed just before the final assembly. The photo on the facing page shows engineers from JPL checking out the lander module prior to final assembly. (Courtesy NASA)

wiring board which in turn is attached by a short flexed cable to the preamplifier board. The CCD is a front illuminated frame transfer array with 223um-square pixels. Its image array is split into two square frames — one for each of the stereo fields of view. Each has 256 x 256 active elements, with a 256 x 512 storage section located under a metal mask.

The stereoscopic imager includes two imaging triplet lenses, two path folding mirrors separated by 150mm for stereo viewing, a 12-sector filter wheel in each path and a folding prism to place the images side by side on the CCD focal plane. Fused silica windows at each path entrance prevent intrusion or contamination by dust.

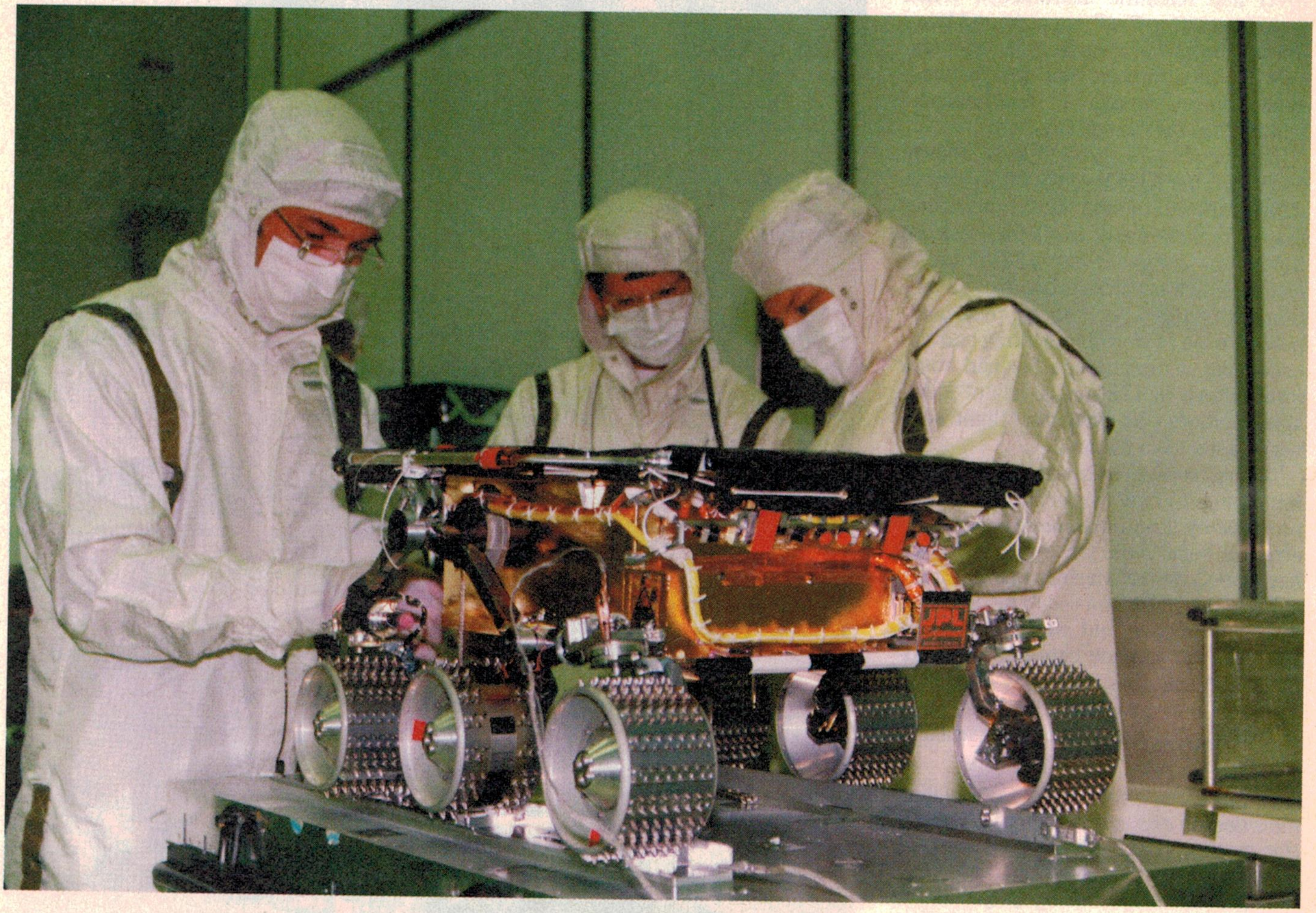
The optical triplet lenses are an f/10 design stopped down to f/18, with 23mm effective focal lengths and a 14.4° field of view. The filter wheel will provide eight channels for geologic studies, two for water vapour detection, a blue filter for atmospheric dust and a broadband filter for stereo viewing.

Full panoramas of the landing site will be acquired during the mission using the stereo baseline provided by the camera optics. In addition, monoscopic panoramas will be acquired both prior and subsequent to the mast deployment, yielding vertically displaced stereo pairs with approximately an 80 centimetre baseline. Images of a substantial portion of the visible surface will be acquired in multispectral images with as many as eight spectral bands.

A number of atmospheric investigations will be carried out using the IMP's images. Aerosol opacity is measured periodically by imaging the Sun through two narrow-band filters. Dust particles in the atmosphere are characterised by observing the sky at sunrise and sunset, using multiple filters and by observing the Martian moon Phobos at night. Similarly water vapour abundance is to be measured by imaging the Sun through filters in the water vapour absorption band and in the spectrally adjusted continuum. Images of wind socks located at several heights above the surrounding terrain will be used to measure wind speed and direction.

A magnetic properties investigation is included as part of the IMP investigation. A set of magnets of differing field strengths are mounted to a plate and attached to the lander. Images taken over the duration of the mission will be used to determine the accumulation of magnetic particles in the wind-blown dust. Multispectral images of these accumulations may be used to differentiate among likely magnetic mineral compositions.

In the first few days of being on the Martian surface, the IMP will take several panoramic photographs of the planet's landscape. Scientists will be using the IMP to study Martian geologic processes and interactions between the surface and the atmosphere. Panoramic stereo imaging will take place at various times of the day. Observations over the duration of the mission will reveal changes in the landscape over time that could be caused by frost, dust, erosion, redistribution of sand or any other surface-atmosphere interactions.



The Sojourner rover undergoes a final functional check in KSC's Spacecraft Assembly and Encapsulation Facility. After Pathfinder lands on Mars, the rover will be instructed to explore the Martian terrain.

The Sojourner

One of the highlights of the Pathfinder mission will be the debut of the rover carried aboard the spacecraft. A contest sponsored by NASA and The Planetary Society, open to all US students, decided what the rover would be named. As a result it was christened 'Sojourner', after an African American reformist Sojourner Truth, who made it her goal to 'travel up and down the land' during the time of the American Civil War, advocating freedom to all people of all races.

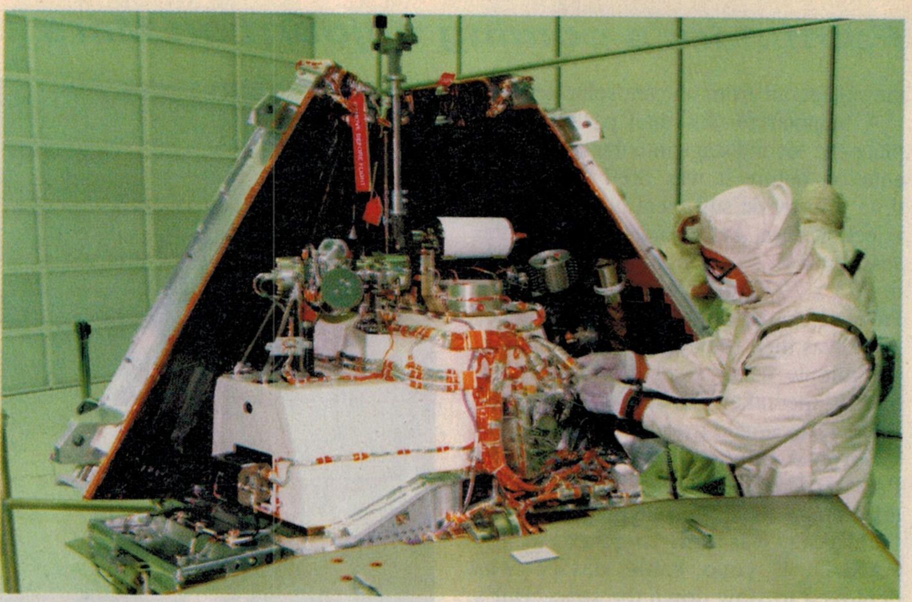
Sojourner with its mounting and deployment equipment weighed 17.5kg at launch, but once it is mobile and operating on the Martian surface it will weigh in at only 10kg. The vehicle, which measures 65cm long by 48cm across and is 30cm tall, travels at the measured speed of one centimetre per second. During the flight to Mars, Sojourner has been folded into a storage area that measures 18cm tall.

Sojourner is powered by a $0.2m^2$ solar array, which is sufficient to power the rover for several hours per day even during dust storms. As augmentation and backup, lithium/sodium dioxide D-cell batteries are enclosed in the rover's thermally protected warm electronics box. Thermal protection is provided by a material known as silica aerogel. Three radioisotope heater units which are approximately the size of a torch battery contain small amounts of plutonium 238, which give off heat to warm the rover's electronics.

A six-wheeled rover, Sojourner uses a rocker-bogie system that is unique in that it does not use springs. Rather, its joints bend and conform to the surface that it is travelling over. This provides a greater degree of stability when the rover travels over rocky and uneven surfaces.

A six-wheel chassis was chosen over a four-wheel design for greater stability. One side of Sojourner could tip as much as 60° as it climbs over a rock, without falling over. The wheels are 13cm in diameter and are made of stainless steel foil. Cleats on the wheels provide traction and each wheel can move up and down independently of all the others. Three motion sensors along Sojourner's frame can detect excessive tilt and stop the rover before it tips over. Sojourner has been designed to climb over a boulder or rock that is 25cm high, and keep on going.

Sojourner will be performing a series of technology experiments that will be providing data to improve the design of future planetary rovers. These experiments will include dead reckoning, path reconstruction and vision sensor performance of the rover, terrain geometry reconstruction from lander/rover imaging and basic soil mechanics (by imaging wheel tracks and wheel sinkage).



JPL engineer Jerry Gutierrez checks the lander module's pyrotechnic system during final testing. Part of the Sojourner autonomous rover is just visible above his right hand.

In addition, Sojourner experiments will also determine vehicle performance, rover thermal conditions, communications effectiveness and material abrasion by sensing the wear on different thicknesses of paint on a rover wheel. Scientists will study adherence of the Martian surface, by measuring dust accumulation on a reference solar cell that has a removable cover, and by directly measuring the mass of accumulated dust on a quartz-crystal microbalance sensor.

The rover's control system calls for an operator to choose targets, and the rover to autonomously control how it reaches the targets and performs its tasks. The onboard computer system is built around an Intel 80C85 processor, which was selected for its low cost and resistance to single event upsets from certain types of radiation. It is an 8-bit processor which runs at 100,000 instructions per second. Sojourner also carries an alpha proton X-ray spectrometer which must be in contact with rocks or soil to measure the chemical composition of the material being studied.

Preparing for launch

The Mars Pathfinder spacecraft was constructed by the Jet Propulsion Laboratory in Pasadena, California. It was transported to the Kennedy Space Centre in Florida by a specially designed van, arriving there on 13 August 1996 with the Sojourner rover arriving on 23 August. Once at KSC, the spacecraft was shifted to the Spacecraft Assembly and Encapsulation Facility where preparations were made for launch.

One of the most important things that ground staff had to do before launch was to ensure that the Mars Pathfinder spacecraft was free of any Earth contamination. Planetary protection requirements called for the spacecraft's surface to contain a maximum of 300 spores per square metre. To meet this goal, the spacecraft was cleaned to a level consistent with the Viking spacecraft before they were sterilised. Technicians constantly cleaned the spacecraft by rubbing the surfaces with an alcohol solution. Large surface areas such as the parachute and airbags were cooked for 50 hours at 110°C. The spacecraft was checked constantly during preparations for launch and given a final planetary protection inspection before launch.

The spacecraft was launched on a Delta II 7925 launch vehicle from Launch Complex 17B at the Cape Canaveral Air Force Station at 1:58am (local time) on 05 December 1996, after three days of delays caused by bad weather and technical problems. When the spacecraft reached 118 kilometres, main engine cut off occurred. Second stage ignition took place 2.5 minutes later and when the spacecraft reached an altitude of 189 kilometres, the second stage engine cut off.

The spacecraft then coasted for an hour, to reach the correct orbital position from which to leave on its trajectory towards Mars. During the coasting phase two important spacecraft events occurred. Spinning at the rate of 1° per second, the spacecraft repositioned itself so the axis of rotation was perpendicular towards the Sun. This attitude adjustment, known as the 'barbecue roll manoeuvre', protected

the spacecraft from uneven solar heating.

A manoeuvre was then performed to place the second stage into the correct orientation before it was fired the second time to provide sufficient energy for the injection burn. At the end of the burn, the spacecraft was in a highly elliptical orbit of 173 x 2974km around the Earth. The Payload Assist Motor (PAM-D) upper stage was then spun up to 70 revolutions per minute using a set of spin motors. Shortly thereafter, the spacecraft and the PAM-D separated from the second stage.

Seventy minutes after launch, the PAM-D fired its engine to prepare for third stage separation. Whilst the Mars Pathfinder was still attached to the PAM-D, a yoyo cable device was deployed to slow down the spacecraft's spin rate from 70rpm to 12rpm. Once that occurred, the spacecraft separated from the PAM-D booster. NASA's Deep Space Network (DSN) 34m antenna at Goldstone, California then acquired Pathfinder's X-band signal.

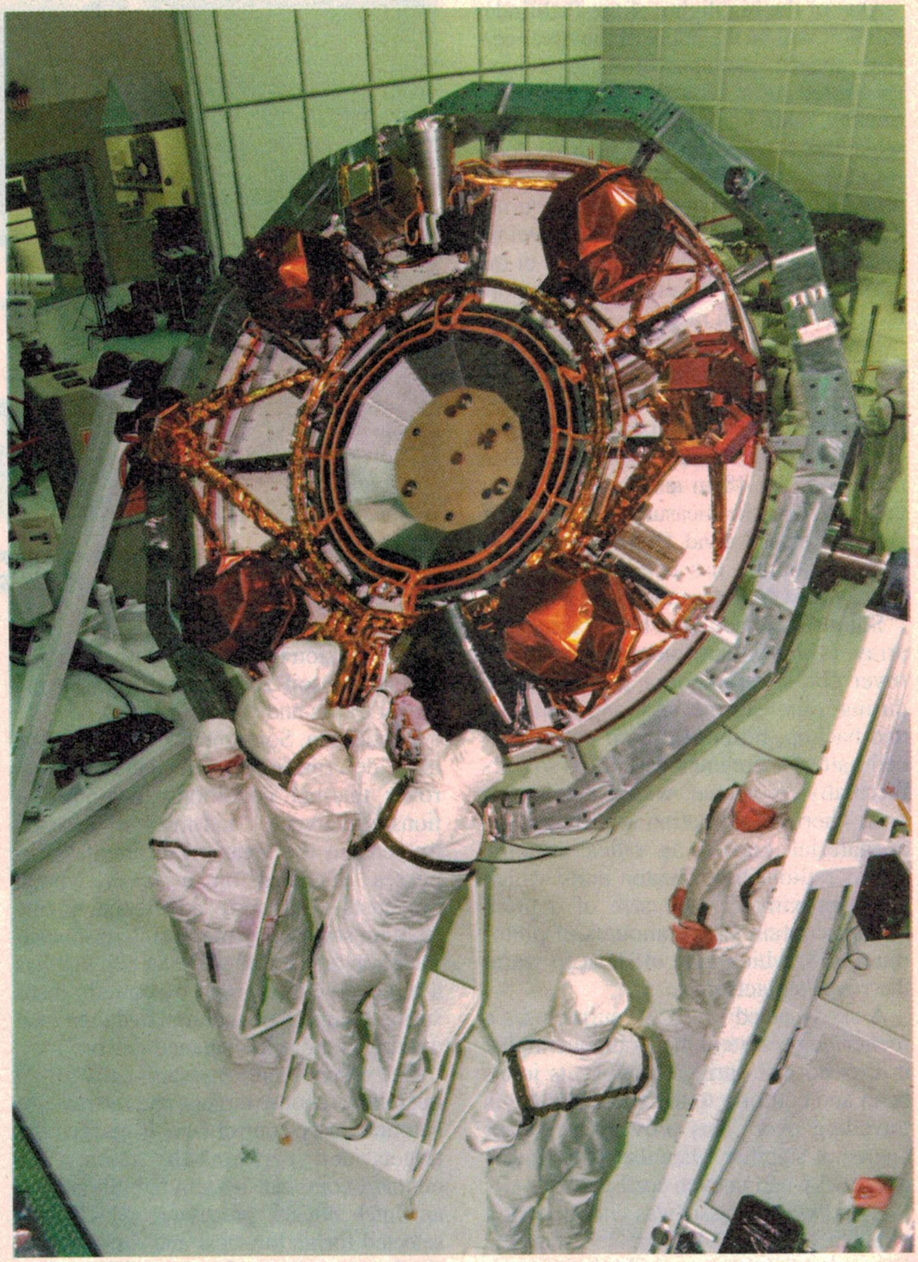
Immediately after separation, the spacecraft passed through the Earth's shadow. Once the spacecraft exited from the shadow, its sun sensor locked onto the Sun. The sensor calculates the angle of the Sun with respect to the spacecraft and provides that information to the flight computer.

The spacecraft then entered a quite state after solar acquisition and health assessments. A two-way communication link was established to allow for navigation tracking and uplink capabilities. In addition, brief health checks of the instruments and stowed rover were performed.

Thirty hours after launch, the spacecraft began to spin down. During this time, Mars Pathfinder determined its orientation in space by locating certain stars and then adjusted its position to be in a direct line of sight. Spin down was performed in a series of steps, with the spacecraft assuming various intermediate rates before achieving the desired 1.9rpm cruise rate.

After the spacecraft's orientation was determined, ground controllers began a fortnight-long period of checking out and calibrating subsystems including the battery, solar array, thermal control functions, radio frequency subsystem and attitude and control functions.

The first trajectory correction manoeuvre (TCM) was originally scheduled for 03 January 1997. However, during testing for the TCM, it was discovered that due to the partial obscuration of the sun sensors that occurred soon after launch, the attitude control software would have



The cruise stage of Mars Pathfinder is seen here inside a support assembly, being prepared for the mission in KSC's Spacecraft Assembly and Encapsulation Facility. The lander module in its protective aeroshell had not been added.

unnecessarily fired the spin thrusters. Although this would not be dangerous to the spacecraft, it was decided to not to fire the thrusters unless absolutely necessary. The problem was solved by changing a parameter in the flight software that would partially reject any bad sun sensor data. It was also decided to postpone the TCM for another week.

After the attitude control software was successfully updated, the first TCM was performed on 09 January 1997. The manoeuvre used two of the spacecraft's eight 500-gram thrusters to fire for a period of 90 minutes, to change the velocity of the spacecraft by 31m/s. This manoeuvre was performed to correct small launch vehicle targeting errors and reduce the planetary protection trajectory bias. Later the spacecraft's spin axis was turned 35° back towards the Earth, so radio navigation could be performed more effectively.

After the TCM, the Deep Space Network coverage was reduced to three 4-8 hour passes per week, with the spacecraft transmitting data at 40 bits per second. Coverage by ground stations was only increased just before the second and third TCMs. The second TCM was to take place around 60 days after launch,

with the third TCM performed 60 days before arrival at Mars.

Arrival at Mars

A final health and status check of the instruments and rover will be performed at 15 days before Mars entry. The fourth TCM will be performed 10 days before Mars entry, to ensure that landing occurs within the defined 300 x 100km ellipse on the Martian surface. At six days before entry, the spacecraft will turn about 7° to orient itself for entry.

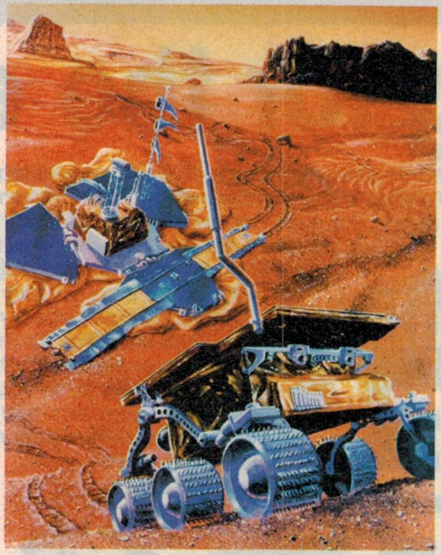
Five days before Mars entry, a command will be issued to the spacecraft to enter a computer mode called the entry, descent landing control mode. In this mode, the spacecraft will autonomously control many activities as it enters the Martian atmosphere, descends and lands. After the spacecraft enters this mode, it will power on the accelerometer, the atmospheric structure instrument and charge the lander's battery.

The entry, descent and landing phase begins 12 hours prior to Martian arrival and ends when the lander's petals are fully deployed. Key activities during this phase include cruise stage separation, entry, parachute deployment, radar altimeter operations, airbag deflation, rocket-assisted deceleration burns, impact, airbag retraction and petal deployment. Real-time communication with the flight system will be possible through impact and possibly until the lander petals are deployed, depending on the landing orientation.

The entry trajectory for Mars Pathfinder is a ballistic, direct entry with a initial velocity of 7.6km/s and a mean flight path angle of 14.2°. The entry velocity is approximately 80% faster than that of the Viking landers in 1976 — the Vikings descended from Martian orbit, whereas the Mars Pathfinder will enter the atmosphere directly from its interplanetary trajectory.

The peak aerodynamic deceleration during entry will be 20 times the force of gravity, and occurs 70 seconds after entry. A parachute will be deployed between 135 and 190 seconds after entry at an altitude of 6 - 10km. Once the parachute is deployed, the flight path angle begins to bend over until the spacecraft is descending nearly vertically. Landing will occur between 225 and 330 seconds after entry. This variation is caused by altitude uncertainties at the landing site and navigation targeting errors.

The parachute will be deployed by firing a mortar to push the chute out of its canister. The heat shield will be released by a timer signal 20 seconds after parachute deployment, to provide sufficient time for the chute to inflate and stabilise. The lander will be released from the backshell on a 20-metre bridle, 20 seconds after heat shield release. This separation distance will increase stability during the solid rocket firing.



An artist's impression of the Mars Pathfinder after landing, with the Sojourner rover out 'exploring' the Martian countryside...

The radar altimeter will begin to acquire data at an altitude of 1.5km above the planet's surface. The spacecraft's airbags will inflate two seconds prior to ignition of the rocket-assisted deceleration and the rockets will fire 1 - 6 seconds before impact. The total burn time of the rockets is approximately 2.2 seconds, but the bridle is cut prior to the end of the burn to allow enough extra thrust to carry the backshell and parachute away from the lander. This will prevent the backshell and parachute from falling onto the spacecraft. The lander will then freefall the remaining distance to the ground.

Hitting the deck

The lander could hit the ground at almost any orientation, as the result of the rocket burn and bridle cut. At impact, the lander will bounce, roll and tumble until all impact energy dissipates. The interval between initial impact and the spacecraft's complete halt could be several minutes long. The airbags completely enclose the lander so subsequent bounces should not result in high deceleration. Each face of the spacecraft's tetrahedron has a single six-lobed airbag and energy is dissipated through vents in between the lobes.

After the lander comes to a complete halt, the next key activities are deflation and retraction of the airbags as well as opening of the spacecraft's petals. Airbag deflation may begin to occur almost immediately after landing due to punctures in the bags; each of the airbags has deflation patches which will be opened to speed up the process. These rip patches are opened by Kevlar cords inside the bags which are connected to a retraction motor. Additional cords are attached to other points inside each bag, so that the airbags can be retracted.

Flight software will control how the airbags are retracted. The three airbags on the sides facing away from the ground will be retracted first. Once these bags have been retracted, the petals will be partially deployed so the lander stands itself right side up. The final airbag on the side originally facing the ground will then be retracted before the petals are fully deployed. If the lander comes to rest on a rock or boulder, the entire lander may be tilted but further manoeuvring of the petals can be performed during surface operations to lower the overall tilt of the lander.

Telecommunications during entry should provide important data about the behaviour of the entry, descent and landing subsystem. Key data to be transmitted to Earth will include accelerometer measurements and selected atmospheric structure instrument measurements. The DSN's 70m antenna in Madrid, Spain will be used to support entry communications.

Mars Pathfinder's main mission will begin when its lander petals have been fully unfolded and the lander switches to a sequence of computer commands that will control its functions. The spacecraft will land about four hours before sunrise on Mars and will spend the time in darkness retracting its airbags, standing itself upright and opening the petals so the solar panels can be powered up at sunrise.

The landing site

For the landing site, NASA scientists selected an ancient flood plain known as the Ares Vallis. Situated at 19.5° north latitude and 32.8° longitude, the site is 850km south-east of the Viking 1 landing site.

There were some constraints on the location. Since both the Mars Pathfinder and Sojourner rover are solar powered, the best site would be one with maximum sunshine and in July 1997, the Sun will be directly overhead at 15° north Martian latitude. The location's elevation had to be as low as possible so the descent parachute would have sufficient time to open and slow the lander to the correct terminal velocity.

(Continued on page 42)

Everything for the enthusiast

The PowerHouse is the one-stop-shop for electronic enthusiasts. Everything you could possibly want is under one roof. From the smallest components and kits to professional testing equipment like state-of-the-art hand held multi-meters and digital oscilloscopes. If you're buying for a gift our experienced staff will ensure your purchase will be well received. Our reference library, huge range of technical books and manuals will keep enthusiasts at the cutting edge of the electronics field. If Ham Radio is your game then our fully operational ham shack and trained staff will help with all your communications needs. So come in and see the new Dick Smith Electronics PowerHouse for yourself. It's more than a store, it's the answer to all your electronics and communications needs.

DICK SMITH ELECTRONICS POWER HOUSE

NOW OPEN IN SYDNEY

BIG BRANDS GUARANTEED BIG VALUES

Sony ICF-SW 7600G SW Receiver

This superb Sony receiver offers full shortwave coverage, plus AM/FM and longwave reception. Its features include a digital tuner, 22 station memories, 4 way tuning, synchronous detector and dual conversion circuity for SW bands. This sophisticated model is SSB receivable, includes separate AN-71 retractable antenna. Only 4 available.

Cat D-2650

SONY

$399

SAVE $100!

Sony ICF-SW100E SW Receiver

Sony quality in an extremely compact flip-open style receiver, providing full shortwave frequency coverage, plus AM/FM/LW reception. Features 50 station memories for storing your favourite frequencies, PLL digital tuning for accurate frequency control, dual conversion SW receiver with synchronous detector for improved reception, and direct keypad frequency entry. Measuring just 111 x 24 x 73mm (WHD), this receiver is ideal for travellers, is SSB reception ready, and comes with a retractable AN-71 antenna. Only 3 available.

Cat D-2652

SONY

$499

SAVE $150!

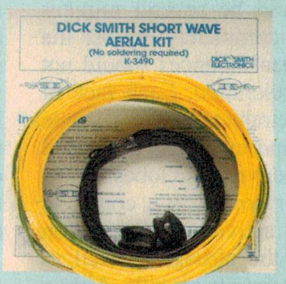
Shortwave Antenna Kit

Get the very best from your valuable equipment with this high-quality shortwave antenna kit. Comes ready for easy self-assembly, with long wire antenna, lead-in, polyrope and "egg" insulators. Requires no soldering. Comprehensive instructions included.

Cat K-3490

$29.90

SAVE $8



VHF Airband Base Station Antenna

For the Airband scanner enthusiast who wants high performance reception, this efficient 1/2 wave base station antenna is a "must have" accessory. Constructed from a strong fibreglass radome, it uses an SO-239 socket in its base for easy coax cable connection. Only 3 available.

Cat D-4824

5 YEAR WARRANTY

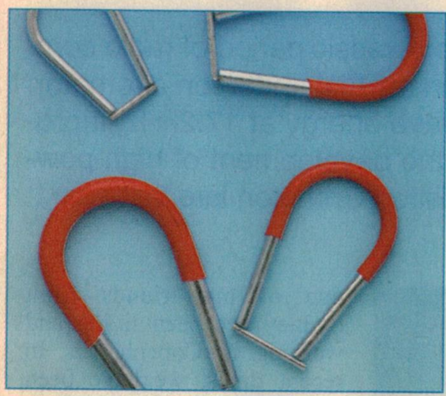
$49.95

SAVE $30

Weller Crescent UTILUX SCOPE Canon

All Purpose Magnet Set

Great for hobby and craft use, as well as for educational experiments in magnetic fields.



Cat H-6006

$4.95 SAVE $3

Medium Horseshoe Magnet

Cat H-6007 **$4.95** SAVE $4

Not illustrated

Large Horseshoe Magnet

Cat H-6008 **$9.95** SAVE $5

Not illustrated

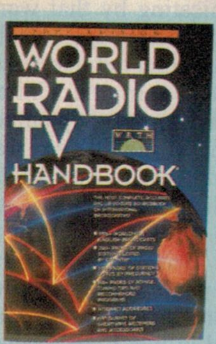
AF Floppiclene

Cleans your floppy drives to keep them in peak operating performance.

Comes with BONUS 12 pack of Dysan disks!

Cat N-3111

$19.90 SAVE $13

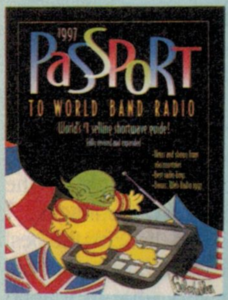


World Radio TV Handbook

This latest edition of the Shortwave radio listener's bible has been long recognised as the most authoritative and up-to-date publication on the world's long, medium and shortwave radio and television stations, Ideal for the broadcasting professional, committed enthusiast and shortwave listener.

Cat B-2097

$34.95



Passport To World Band Radio

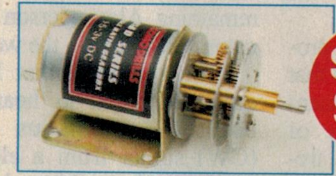
Updated international shortwave radio broadcasting handbook which no shortwave radio listener should do without. Particularly suited for beginners looking for an easier way to tune into the exciting world of broadcasting. Covers current international SW frequencies, transmission times and sites, sunspot activity and equipment reviews.

Cat B-2058

$34.95

Motorised Single Ratio Fixed Gearbox

With 1.5V-3V DC RE280 motor, Fixed Ratio of 100:1. Miniature gearbox of steel and brass, mounted on 1m thick steel bracket, incorporating a high quality 3-pole DC motor with sintered bronze bearings. Suitable for hobbyist models to light industrial applications.



Cat P-9050

SAVE $10 **$29.50**

HPM Automatic Light Switch

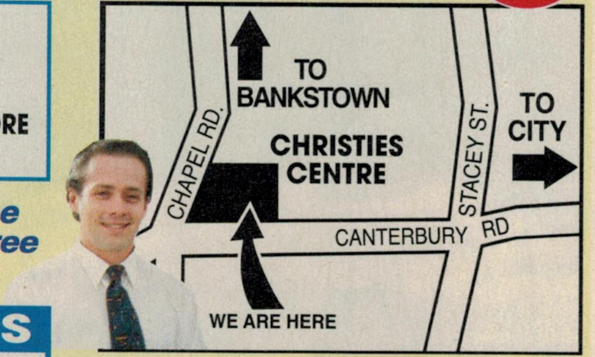
Automatically turns on when someone enters the room and switches off after they leave. Save power by not leaving lights on unnecessarily. The unit can be overidden by switching from auto to manual, it then operates as a normal on/off switch. Stay on time can be set between 10 and 15 seconds and it has adjustable sensitivity.

Cat M-7035

$49 SAVE $30

- ☑ EXTENDED ELECTRONICS RANGE
- ☑ TECHNICAL LIBRARY
- ☑ KNOWLEDGEABLE STAFF
- ☑ WORKING DISPLAYS OF KITS, SECURITY SYSTEMS, COMMUNICATIONS, TEST EQUIPMENT AND MORE

No Dick Smith Electronics store, other than the PowerHouse, stocks these products. But feel free to take advantage of our mail order service.



PHONE, FAX & MAIL ORDERS

PHONE ORDERS All Areas (Local Call) 1300 366 644

FAX ORDERS (02) 9805 1986 **MAIL ORDERS** REPLY PAID 160 PO Box 321, NORTH RYDE 2113

No postage stamp required

VISIT OUR WEB SITE www.dse.com.au

Offers expire end June 1997

Christies Retail Centre

Cnr Canterbury & Chapel Rds

BANKSTOWN Ph: (02) 9793 9677

bankcard MasterCard Diners Club International American Express VISA eftpos LAY-BY AVAILABLE

CRC WELESCO Tektronix RHINO FLUKE

GRIMETON'S DINOSAUR

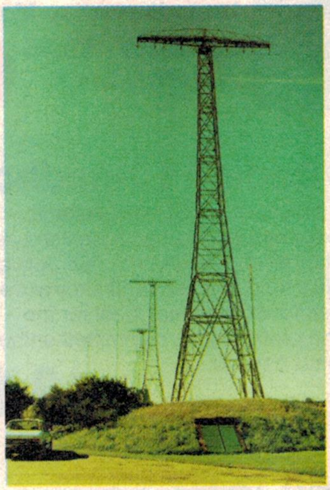
In the town of Grimeton in Sweden lives a veritable 'monster' from the Jurassic period of radio communication: the last surviving long-wave transmitting station based on an Alexanderson alternator. Still operating and developing a husky 200kW of clean continuous wave energy at 17.2kHz, it provides a remarkable glimpse of the era early this century just before the development of high-powered transmitting valves. Here's what Peter Jensen found when he visited Grimeton late last year...

by PETER R. JENSEN, VK2AQJ

In September 1995, the British Institution of Electrical Engineers held a centenary conference in London to mark the first transmission of Marconi in Bologna in 1895. The conference covered a substantial array of topics relating to the history of radio, and I was fortunate enough to be able to attend.

During the course of the proceedings, it was announced that there would be a segment involving a presentation of slides concerning a high frequency alternator transmitter at Grimeton. In due course this segment turned out to be a video presentation made in 1985 and in that respect was a good deal livelier than a 'slide show' could have hoped to have been. Towards the end of the presentation it was announced that shortly we would be able to hear the 'voice' of Grimeton. By courtesy of one of the BBC monitoring stations in the UK, a message in impeccable Morse code was soon heard in the auditorium, extending greetings to the participants in the conference from the oldest and only remaining Alexanderson alternator transmitter in the world.

I must confess that I was quite intrigued to hear this beautiful continuous wave (CW) signal from a electromechanical machine, having at that stage little knowledge of the devices that provided the transition between rotary spark and valve transmitters. Grimeton duly went onto my list of places to visit, one of these fine days. As it happened, this particular 'fine day' was rather sooner in coming than later.



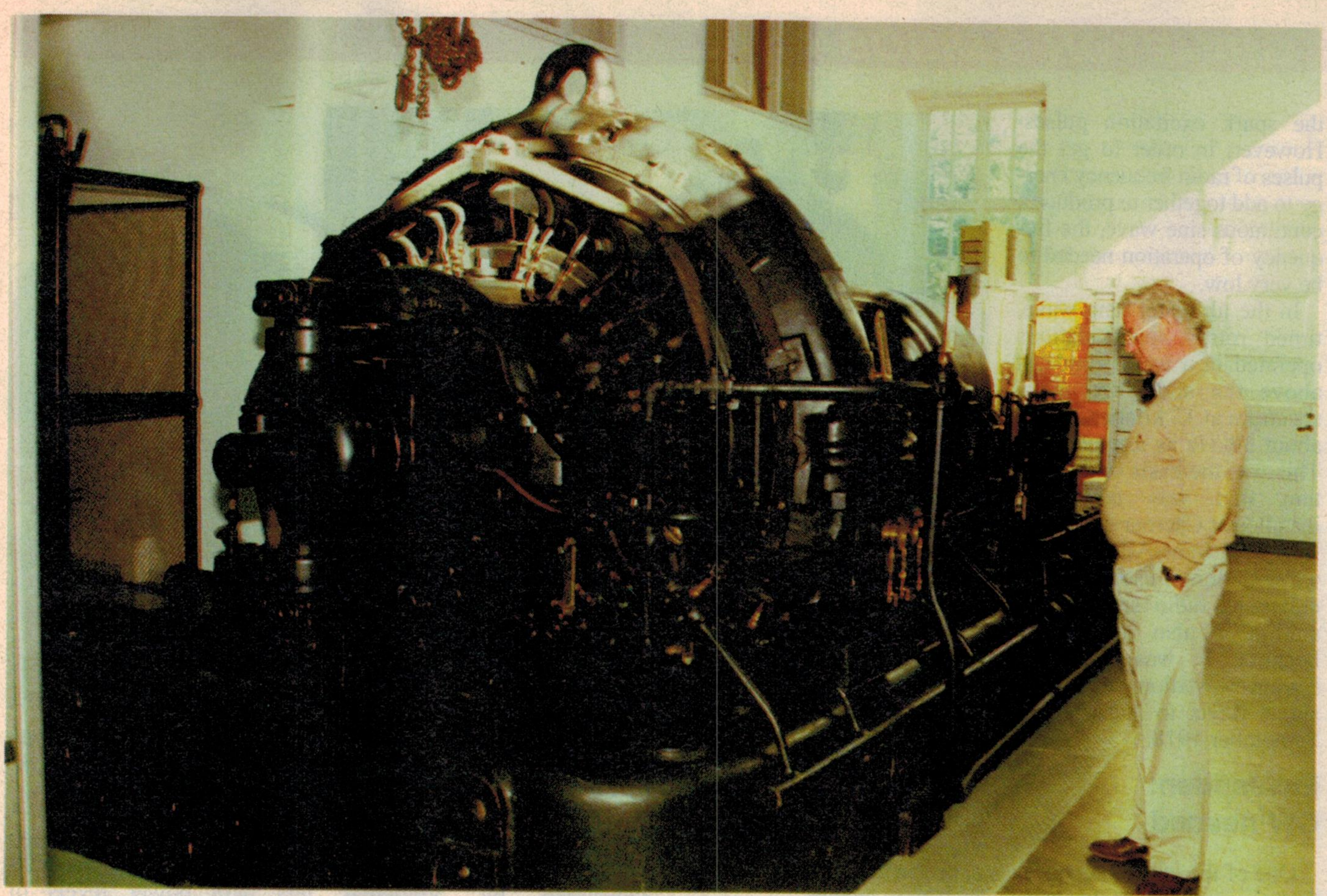
The station's six 127m-high antenna masts are T-shaped and immediately visible as you approach...

For the last couple of years one of my friends from Sydney has been living and working in Copenhagen. In recent times, we have been communicating by that wonder of the Internet age, e-mail. When he found out that I was likely to be in the United Kingdom during September of 1996, an invitation was extended to visit Copenhagen and with that it was an easy decision to extend the trip to include Grimeton. For the arrangements to go to Grimeton, again e-mail was used and in this I was helped by a number of people on the Internet who had heard of an earlier publication of mine.

About a week after I had arrived in England, I was off to Heathrow airport again and from there flew across the North Sea to Copenhagen. I had last visited that city the best part of 40 years ago and could remember very little of it apart from the main square, Kongens Nytorv. My friend was waiting for me in the thoroughly modern airport and soon we were driving to his apartment beside one of the old docks on the northern side of the city.

A couple of days later, having done some sight seeing, we set off to drive to Grimeton on a particularly beautiful day. The radio station is located to the north of Helsinborg, close to the town of Varburg, which in Sweden appears to be pronounced 'Varberry'. Accordingly, we had to cross over to Helsingborg in Sweden by ferry, from Helsinger in Denmark. (This is the town made famous by Shakespeare in the play 'Hamlet' as the site of the castle of Elsinor.)

Built in 1924, the transmitter hall is quite impressive — although dwarfed by one of the antenna masts.



The Alexanderson alternator seems huge — like an escapee from the Snowy Mountains hydro-electric project! It handles 400kW of mechanical energy, and produces up to 200kW of output at 17.2kHz.

T-shaped antennas

Fine roads and limited interruptions due to road works saw us cover the hundred kilometres or so north from Helsinborg in a bit over two hours. There at last on the skyline were the unmistakable 'T' shaped antenna masts of the Grimeton station and after some driving around, we arrived at our destination: the Radio Station building. There we were met by our friendly host, Mr Bengt Davas the station Superintendent.

Initially I admired the huge external antenna coupling helix, standing on its concrete base. Unfortunately someone was carrying out maintenance on the structure and this proved inconvenient later. The antenna cable stretched away into the distance, looping over the huge lattice masts. We then walked into the transmitter hall to meet the 'beast'.

In order to understand the part that the Alexanderson alternator was to play in radio history, it is necessary to go back to a somewhat earlier date than 1924 and look at the technology that was used for radio communication initially. This was of course the system developed by Marconi, based on the radio frequency energy of a 'spark'.

Although the 'spark' was the basis of all the early transmitters, it did not take long for users of the new communication system to realize that it was an intrinsically very noisy and wasteful method of producing radio frequency energy. More seriously, because it really consisted of a burst of RF energy at no particular frequency, the result was a broad band of noise that spread all over the spectrum as pollution or interference to other users.

Ironically the experts who worked for Marconi, such as Dr Fleming, were initially of the opinion that the spark was the only way to create the 'disturbance in the aether' which would spread out as an expanding wave of energy able to be used for signalling purposes. As we now know this assumption was quite erroneous.

Over a 15-year period from 1896, more and more experts came to realize that in fact any high frequency alternating electric current was capable of being propagated as radio frequency energy. More importantly was the related conclusion that a sine wave form of continuous waves was required if tuning or 'syntony' was to be achieved: For this reason spark transmission was a technological 'dead end' that could never be entirely successful.

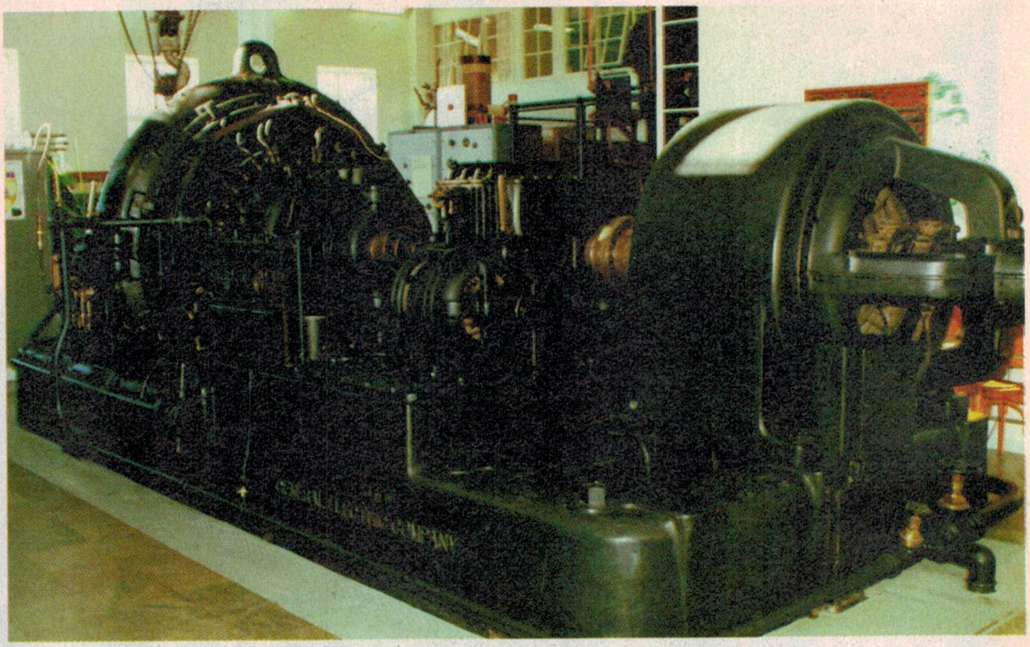
However, despite its intrinsic limitations, major efforts were made during this period to improve the characteristics of the spark. By the end of the First World War in 1918, Marconi was able to claim that he was producing a signal that was equivalent to the continuous wave or 'CW' energy that by then was able to be produced by other devices.

Marconi's most clearly documented method of creating something approaching a continuous wave from spark energy, although perhaps not his last, was to couple together multiple rotating spark wheels so that each burst of spark energy added to that which had gone before. In addition, because of the rapid rotation of the spark wheel, each burst of spark energy was made very short: 'quenched' in fact.

The succession of short bursts of energy had the effect of shocking the antenna system into resonance at its natural frequency, and what was produced was a continuous wave — with some residual modulation at the frequency of

the spark excitation pulses. However, in order to get the pulses of radio frequency energy to add together to produce a continuous sine wave, the frequency of operation needed to be very low.

In the ultimate, long wave, timed rotary spark stations operated in a band from just above the audio frequency spectrum at 12 kilohertz up to about 30kHz as a maximum. This was the basis of the system that was ultimately installed at Caernarvon — the last great trans-Atlantic long wave station to use a spark to create its radio signal. This station is also noteworthy because it was the first European station to send a signal direct to Australia, in September 1918.



Some Alexanderson alternators were driven by steam turbines, but Grimeton's is driven by electric motor via a step-up gearbox. The arrangement is shown in the diagram below.

Fessenden: CW needed

One of the experts who saw that the way ahead lay with other methods of RF energy production was the Canadian, Professor Reginald Fessenden. He was to state with great clarity, as early as 1899, that the ultimate method of generating RF energy had to involve waves of continuous alternating current. This perception built on the foundation established by Oliver Lodge, who had very early realized the importance of tuning and resonance in the context of radio frequency energy.

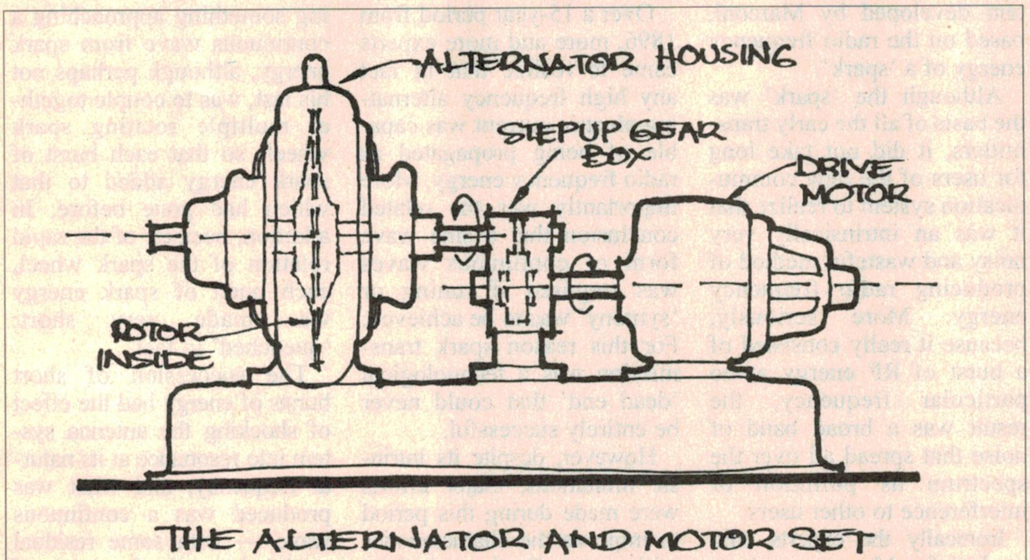
While the Marconi Company clung tenaciously to spark technology, Fessenden sought for ways to produce CW energy and finally concluded that the best method would involve the development of a radio frequency alternator.

Although at the time this was probably the most fruitful avenue for Fessenden to be pursuing, there was another major contender that had been developed by Valdemar Poulsen in Denmark, from the earlier work of Tesla in the USA and Duddell in the UK. This was the *arc* radio frequency generator, which could produce rather impure continuous wave RF energy from a direct current (DC) source.

In the USA during the First World War, this technology was developed by expatriate Australian Cyril F. Elwell — so that by 1920, the American Navy were using arc transmitters with power levels of between 200 and 500 kilowatts and power into the antenna of about half those figures. These transmitters were built by the Federal Telegraph Company of California and came to be the basis of the 'standard' Naval system in the USA until the early 1920's.

The device that was ultimately to make all these methods obsolete was not invented until 1905, and then only used for receiving purposes in the first instance. However as a generator of radio frequency energy at significant levels, the thermionic valve or 'tube' as it was to be known, did not come into its own until the latter part of the First World War. After this time, it swept all other technologies before it and was the means by which 'broadcasting' became feasible in the early 1920s, remaining as the basis of all radio communications and computing until well into the 1960s.

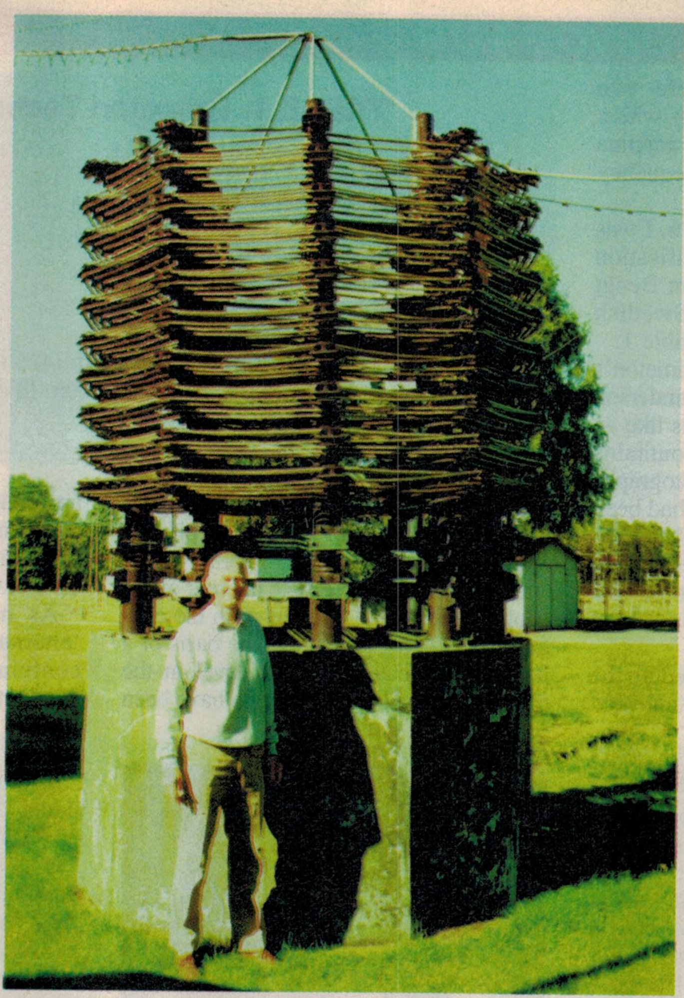
Although described by his contemporaries in less than flattering terms as egotistical,



THE ALTERNATOR AND MOTOR SET

arrogant and overbearing, it is clear that Fessenden had a highly innovative turn of mind. When in 1899 he specified the form that future radio frequency generation would have to take, it was in the knowledge that even if he was correct, at that time there was no way in which such continuous wave energy could be detected. The coherer required sharp pulses of high voltage energy to switch into a conducting mode and as modern experiments have shown, it is remarkably 'deaf' to the impact of continuous wave energy.

Fessenden solved this problem by inventing a detector which appears to have been close to a modern diode detector in its action, and which was described as a 'liquid' or 'electrolytic' detector. Later he was to invent a far more sophisticated method of detecting continuous wave energy, involving heterodyne mixing as it would ultimately be called. This process of heterodyne detection forms the basis of the 'product detector' as now found in any Single Sideband receiver.



Grimeton station Superintendent Bengt Davas with the huge external antenna coupling helix, standing on its concrete base.

Approach to GE

In 1904, Fessenden approached General Electric in the USA to build him an experimental alternator, to test out his theory of continuous wave propagation. This device, he had specified, should operate at a frequency of 100kHz. As developed by General Electric, the alternator consisted of a stationary armature set between two rotating steel disks which had projecting poles or teeth cut in their circumference. These days one would call this an induction type alternator, and in principle it was derived from the earlier work of Tesla and Duddell.

By 1906 the experimental alternator had become a device that employed a single 300mm diameter rotor set between the poles of a stator and capable of generating a continuous wave at a frequency of 50kHz. This transmitter was used to broadcast the first pure radio telephony signal from Brant Rock Naval Radio Station in Massachusetts, in August of 1906.

The question of purity is relevant in that there had been earlier attempts to modulate spark-generated radio frequency energy, but the resultant transmitted audio had been both noisy and distorted.

The Brant Rock transmission of telephony using the experimental alternator was heard up to 11 miles away by a number of surprised Naval telegraphists, who were using crystal detectors which were able to demodulate the telephonic information carried on the radio frequency envelope. In this instance it appears that the power output of the transmitter was about 500 watts.

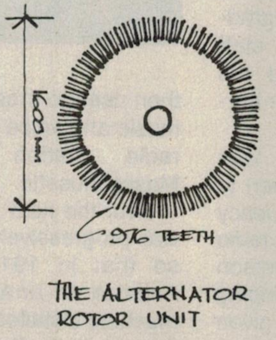
Shortly after this, and perhaps based on a freak of propagation, a radio telephone signal was heard on the other side of the Atlantic in Scotland. However, at the time, the feat was not publicised, no doubt because Fessenden feared that his claim would be disputed as vigorously as had been Marconi's when his signal had crossed the Atlantic in 1901. This is particularly ironic as Fessenden had been one of the most vociferous critics of Marconi's work at that time.

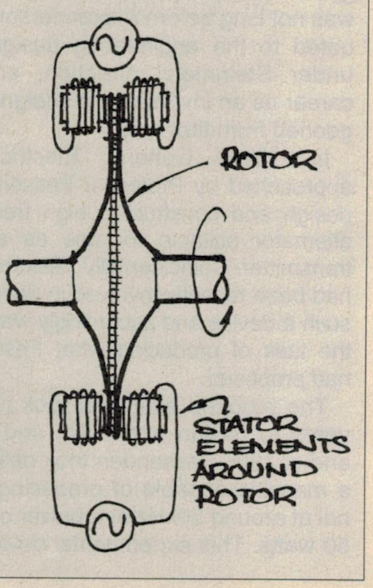
However on Christmas Day and then again on New Year's Eve 1906, the experiment with broadcasting of voice and music was repeated. This time the signal was widely heard, so that coyness about what had been achieved was no longer necessary. In addition, given the 500-watt power of the Brant Rock alternator, this has to be seen as lending strong support for Marconi's earlier claim of 1901 in which 12kW had been used in the transmitter used at Poldhu in Cornwall.

Alexanderson's alternator

Following these successes, the young engineer who had been given the task of developing the alternator by General Electric, Ernst Alexanderson, progressively refined and expanded its power. By 1919, the Alexanderson alternator had been developed into a machine with an input power of 400kW and an operating frequency at around 16kHz.

As finally installed at





The Alexanderson alternator at Grimeton uses a 1600mm-diameter rotor with 976 teeth, rotating at 2115rpm. Pairs of coils around the stator generate the RF output.

Grimeton in 1924, there were two machines in use (one on standby), which produced a power level in the antenna system of around 200kW at a frequency of 17.2kHz.

Using e-mail in February 1996, I was able to obtain the technical specification of the Grimeton Alternator from Bengt Willander, SM7BKH of Swedish Telecom. It is summarised in Table 1.

The first impression inside Grimeton's transmitter hall is that the Alexanderson alternator is huge. Indeed it looks like an escapee from the Snowy Mountains Hydro-electric project. In photographs that I had seen previously, there had been nothing to provide a sense of scale and so the surprise was considerable. However, given the 400kW power input of this machine, I suppose that I should not have been so taken aback.

Later, when Bengt Davas started up the machine, its size was very much mirrored by the incredible noise level that was generated: a combination of a high pitched and powerful scream of the rotating motor and alternator, coupled with the roar of the cooling pumps and overlain with the clatter of the keying relays. On the basis of a personal estimate, the noise level in the transmitting hall would have to have been up around 95dB(A). All quite unforgettable, and not easily conveyed in the video film that I later carried away from Grimeton.

As may be obvious from the title 'alternator', the means of producing continuous waves from an electromechanical device involves techniques

TABLE 1: Grimeton Technical Specs

Station callsign	SAQ
Power input	400kW
Power output	200kW
Rotor diameter	1600mm
Number of teeth	976
Rotation speed	2115rpm
Frequency of CW	17.2kHz
Antenna system (TX)	Six towers, 127m (416 feet) high
Antenna system (RX)	Beverage, 13,000m (8 miles) long
Operation commenced	1925

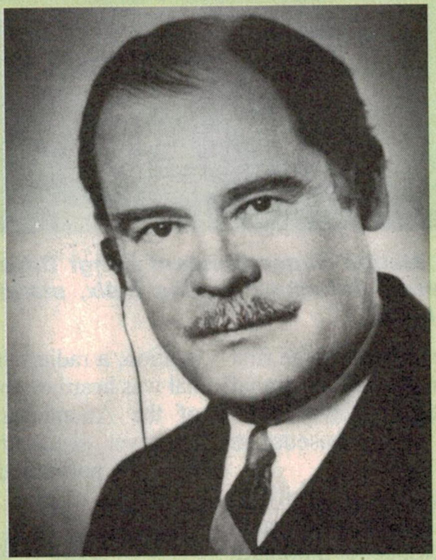
Dr Ernst Alexanderson

The son of Professor A.M. Alexanderson, Ernst was born at Upsala in Sweden in 1878, and lived to the ripe old age of 97. He died in Schenectady, New York in his adopted homeland the United States, having lived an extraordinarily creative and productive life. Forty six of his years had been spent with the American firm General Electric, where he was credited with a remarkable total of 322 patents.

Ernst Alexanderson went to the United States in 1901 as a recent graduate and visited the General Electric Company where its Director of Research, Dr Charles P. Steinmetz gave him a job in the drafting office. It was not long before Alexanderson graduated to the engineering design staff under Steinmetz' direction, and his career as an inventor and designer burgeoned from that time.

In 1904, General Electric was approached by Professor Fessenden to design and construct a high frequency alternator suitable for use as a radio transmitter. Coincidentally, Alexanderson had been recently involved in developing such a device and accordingly was given the task of producing what Fessenden had proposed.

The required alternator took just two years to design and build, and at the end of 1906 Fessenden took delivery of a machine capable of producing a signal at around 50kHz at a power of about 50 watts. This experimental device was



then used to broadcast a programme of music and voice signals from the Naval radio station at Brant Rock, Massachusetts.

Over the next 10 years the alternator was progressively refined and improved so that in 1915, Marconi came to America to arrange to have a 50kW machine installed at his Company's station at New Brunswick, New Jersey. Within a couple of years the alternator had been further refined to the machine that was ultimately installed at both Caernarvon, North Wales and Grimeton in Sweden.

During 1918, General Electric created a new Department of Radio Engineering, which later became the Radio Consulting Department in 1922. Dr Alexanderson became its first head.

In passing, attempts by the Marconi Company to secure rights to the use of the Alexanderson Alternator from General Electric played a considerable part in convincing President Wilson that America should have its own radio company completely independent of British influence. From this came the creation of the formidable Radio Corporation of America: RCA.

Ironically, with the development of the short waves and the high power valve, much of the interest in the long wave, high powered alternators was to wain almost as quickly as it had grown.

Given the decline of the alternator, it is also rather ironic that one of the last of these machines to be commissioned was at Grimeton in 1924, at which time Alexanderson was awarded the Order of the North Star by King Gustav V. This was to be the first of a bevy of awards and honours that were to be bestowed upon him over the next 20 years.

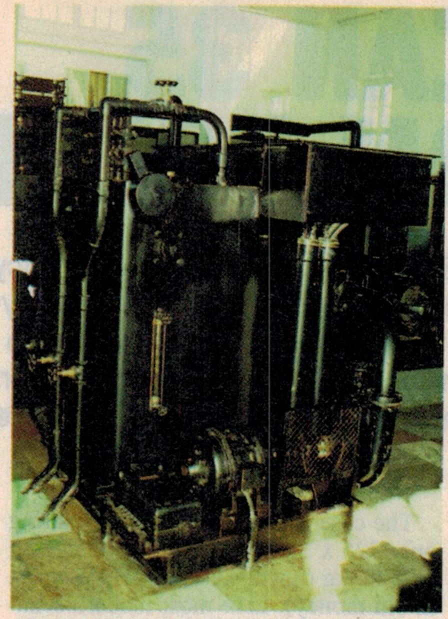
In later years, Alexanderson became involved in early television experiments and when in 1933 General Electric withdrew from the Radio Corporation of America, he concentrated on electric power and its transmission both as direct and alternating current. This later led to the installation of a new form of DC motor for use in trams in Melbourne, driven from a 1500V supply. Alexanderson finally retired from General Electric in 1948.

which derive directly from the generation of alternating current as found in the household mains supply. However, in the case of the Alexanderson alternator, this is no trivial 50Hz or 60Hz alternation but one of 17.2kHz and involving a power of rather more than 200kW into the antenna system.

Ironic twist

In many respects, the story of the Alexanderson alternator is one of irony. Almost at the moment that it was able to successfully demonstrate that Fessenden was correct in his prediction that continuous wave RF energy was the way of the future and spark-generated energy a 'blind alley', the high power transmitting valve was to make all the earlier devices — the plain, rotary, quenched and multiple spark with timing, the arc and lastly the alternator — completely obsolete and very soon to be shuffled off to extinction.

Apart from its use at Grimeton, the alternator transmitter was to displace the timed spark system developed by Marconi at Caernarvon, and two alternators were installed at that trans-Atlantic station in 1919, one being kept as a 'standby'. However, despite its successful operation in Wales, within only a couple of years it too was to be shut down as a battery of valves were brought into action to produce the station's 150kW signal, and the roar of the alternator died away forever.



The pumps used to provide cooling for the alternator and its load and regulator resistors. Operation commenced in 1925.

Only at Grimeton is it still possible to see and hear the voice of this long extinct creature of the early radio age. And what a beautiful beast it is too! A worthy inhabitant of a latter-day 'Jurassic Radio Park', and one entirely worth a visit by a radio historian or amateur with an interest in the background to the hobby of radio communications.

References

Aitken H.J., *The Continuous Wave*, 1980.

Baker W.J., *A History of the Marconi Company*, Methuen 1970

Editor, 'Ernst Alexanderson: etc.', *Electronics Australia Yearbook 1975/1976*, p14.

Jensen P.R., *Early Radio — In Marconi's Footsteps*, Kangaroo Press 1994.

Pickworth G., 'The Spark that gave Radio to the World', *Electronics & Wireless World* November 1993, p937.

Pickworth G., 'Marconi's 200kW trans-Atlantic Transmitter', *Electronics & Wireless World* January 1994, p28. ❖

SPRINTSCAN 35 PLUS FROM POLAROID

The latest version of Polaroid's SprintScan 35 Plus transparency scanner offers 12-bit per channel internal sampling for improved density range, plus the ability to make scans at up to 2700dpi resolution. For those who need to transfer images from 35mm slides or B&W/colour negatives into a desktop publishing system or other computer application, it offers speed combined with ease of use — and low cost, compared with the main alternative of a drum scanner.

by JIM ROWE

Rapid developments in image scanning technology over the last few years have made it possible for almost anyone who needs one to get hold of a reflective art scanner at very reasonable cost. Some of the latest desktop A4 flatbed models are capable of very impressive performance, too; the HP ScanJet 4C in EA's editorial office has produced some startlingly good scans in the last year or so, for example, in the skilled hands of our production editor Vitek Budzynski. This type of scanner can now be used to produce the kind of scans previously only achieved using a full photomultiplier type drum scanner, yet typically only sells for less than 1/20th the price.

But on the whole, the same developments don't seem to have taken place yet with regard to transparency scanning. Some of the desktop flatbeds are available with optional 'transparency adaptors', but these often cost almost as much as the basic scanner in themselves, and are generally not capable of delivering good results from transparencies as small as a 35mm slide or negative — especially if you want to enlarge them a fair bit, as you often do.

When it comes to scanners designed for 35mm transparencies (apart from very expensive drum scanners), as far as I know there are still really only about four firms offering them. Polaroid has had its original SprintScan 35 (now known as the ES) available for about three years, but has only recently added two new models to its range: the low-end model 35/LE, and the 35 Plus.

The SprintScan 35 Plus seems to be the new top-of-the-range model, and offers enhanced 12-bit per channel internal scanning for greater contrast range and linearity. Physically it looks virtually the same as the original SprintScan 35, apart from the case being finished in matte black. Like the other models it's made for Polaroid in Taiwan.

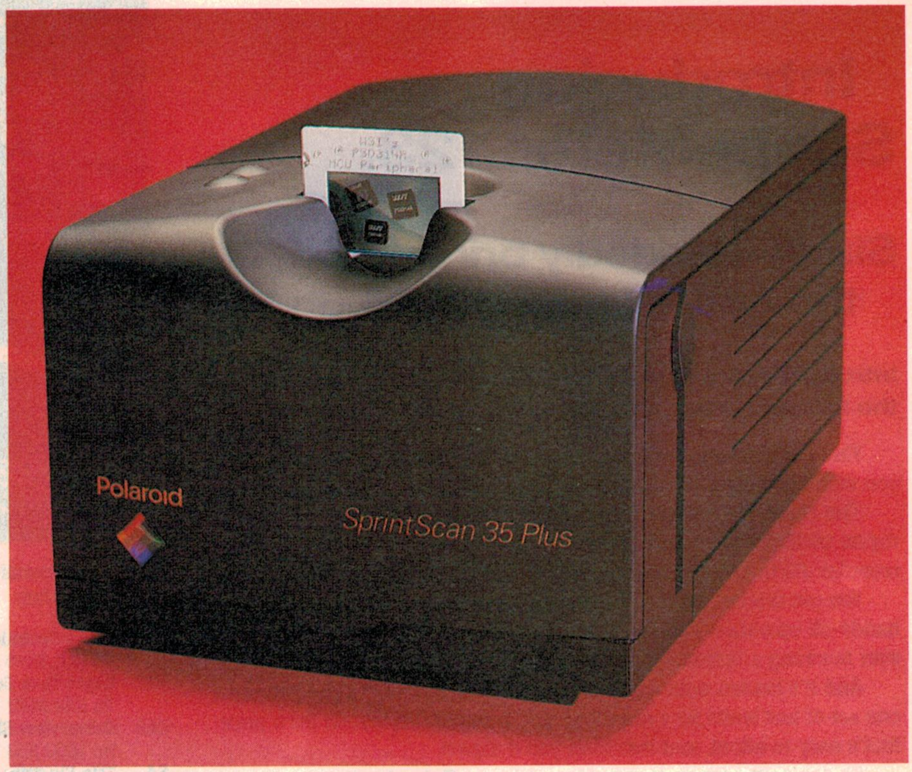
The case is quite compact, measuring only 225 x 178 x 152mm and weighing only 2.3kg (a whisker over five pounds, in old money). Like most modern scanners it hooks up to the computer via the SCSI bus, and in this case operates at SCSI-2 speeds — around 2MB per second transfer rate. It's available with driver software for either Macs or Wintel machines, but in the latter case you also need a suitable SCSI adaptor card if you don't already have one.

Like most modern scanners there are virtually no controls on the unit itself; control is all via software. There are only two LED indicators, one to indicate that the scanner is powered up, and other to indicate that it's 'Ready' (as opposed to 'Busy').

At the rear there's a captive IEC plug for mains input, a power switch, both DB-25 and 37N50 '50-way SCSI' connectors, and a small dual-pushbutton switch to set the scanner's address on the SCSI bus. There's also a switch to either enable or disable an internal SCSI termination, depending on whether or not it's at the end of the cable.

Mounted 35mm slides can be inserted directly into the scanner via a slot on the top. The slide can be inserted in either 'portrait' or 'landscape' orientation, as appropriate, and it will even take larger 'Super Slide' images in the same mount.

Alternatively, if you want to scan images on unmounted positive or negative film, these can be mounted in a filmstrip carrier which slips into a slot in



the side of the scanner. The carrier hinges open at one end to insert up to six images' worth of film, and then clicks back together. An indexing system assists you in locating the carrier with each image correctly in the scanning gate, and the carrier only moves (manually) through the scanner from right to left.

Inside the scanner, there's a 4W 'cool white' fluorescent tube at the front of the scanning gate, which remains powered up all the time. Behind the gate there's the optical scanning system, based on a horizontal RGB linear CCD array.

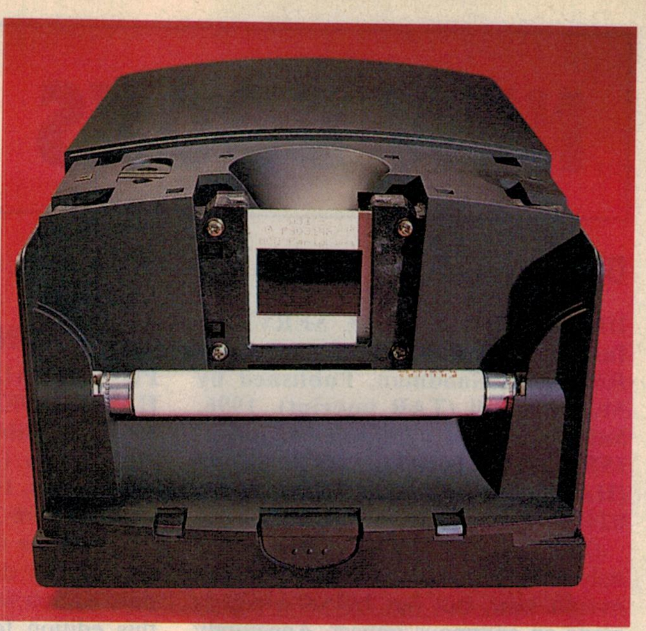
Before scanning takes place each time, the scanner recalibrates itself by 'looking at' the fluoro tube directly, through a slot below the main gate. Then for scanning, the complete scanning gate assembly and slide/film carrier move incrementally under software control down through the horizontal scanning plane, via a precision vertical leadscrew system driven by a stepper motor.

Operation is almost dead quiet — there's a small inbuilt cooling fan, and the stepper motor is barely audible above the faint hum of the fan. At the same time it's quite fast: a 2700dpi scan of a full-frame 35mm positive image generally takes less than a minute, and a smaller-area scan somewhat less.

Most of the image processing is done inside the SprintScan itself, by dedicated DSP hardware. For example the scanner can detect colour casts, and if desired correct for them to produce a properly balanced image. Similarly it can perform auto exposure, sharpening, black/white/grey level and density range adjustment. It can also crop and rotate the image through 90° increments, and of course reverse a negative into a positive — all while making the final scan.

Many of the tonal range adjustments available with the 35 Plus are made possible by the 12-bit sampling for each of the three RGB channels, even though the output images are of standard 24-bit resolution (3 x 8 bits). This gives the ability to cope with a total transparency density range of 0 - 3.4, almost the full range of most film emulsions and not far behind the ability of a drum scanner.

For use with Wintel PCs, the SprintScan 35 Plus comes with a TWAIN driver software module, which allows scanning either independently or directly from an image manipulation package like PhotoShop or Picture Publisher. Either way the software allows selection of scan resolution in a range of steps between 127dpi and 2700dpi, cropping of scanned image area, output scaling factor and so on — plus all of the image manipulation/correction facilities mentioned earlier. It's all very easy, and the software conveniently tells you both the output image file size as well as the image dimensions and resolution.



Removing the front cover reveals the 4W fluoro tube which provides the scanning light source. The slide/film holder is moved down through the scanning plane by a precision leadscrew, driven by a stepper motor.

Trying one out

Polaroid Australia very kindly loaned us a sample SprintScan 35 Plus to try out for a while, and we used it with two different Pentium-based DTP systems — one running at 90MHz, and the other at 133MHz. Both were running Windows 3.11, and already had SCSI-2 controller cards connected to HP ScanJet 4C flatbed scanners.

In each case we found that the TWAIN software driver installed easily, and we were soon making surprisingly good scans.

Basically we found the SprintScan 35 Plus easy to drive, either directly by the TWAIN driver module or indirectly via an editor such as PhotoShop. It's easy to perform cropping, rotation and other manipulation, and the software's 'auto exposure' facility generally gave a good result, except for difficult trannies which needed some manual adjustment.

Operation was commendably quick, too, although we did find that a scan involving conversion of a full-frame colour negative to a positive (plus a bit of sharpening) could take up to 10 minutes on the 90MHz Pentium system. But even on this system most scans from a positive took less than a minute.

We were very impressed with the output quality, too. In fact our impression is that the SprintScan 35 Plus is capable of extracting as much useful information from a standard 35mm image as most people would ever need — including magazines like *EA*.

I think our only minor gripe is that the carrier for unmounted film is a bit fiddly to open and close, and seems a bit fragile.

On the whole, though, the SprintScan 35 Plus seems an excellent performer and really good value for the quoted prices of $2745 for the Wintel PC version and $2857.24 for the Mac version. These prices include sales tax. (For those with a tighter budget, there's the 35/LE model which offers 10-bit scanning and 1950dpi maximum resolution, for only $1331.) ❖

SprintScan 35 *Plus*

High resolution colour scanner for positive and negative transparencies on 35mm film (mounted or unmounted).

Good Points: Scans at up to 2700dpi resolution, to allow large image scaling factors. Internal 12-bit/channel scanning gives excellent density range of 0 - 3.4. Hardware-based realtime colour processing and sharpening (output 24-bit RGB). Scans portrait, landscape and 'superslide' image formats. Fast, very easy to use. Versions for both Wintel and Macintosh PCs.

Bad Points: Nothing serious; strip film holder a little flimsy.

RRP: Wintel version $2745, Mac version $2857.24. Lower-res 35/LE model (1950dpi/10-bit scanning) available for $1331.

Available: Polaroid Australia Pty Ltd, 13-15 Lyonpark Road, North Ryde 2113; phone (02) 9950 7000 or fax (02) 9887 2209.

NEW BOOKS

DSS in practice

DIGITAL SATELLITE SERVICE: Installation and Maintenance, by Robert L. Goodman. Published by McGraw-Hill (TAB imprint), 1996. Soft covers, 234 x 190mm, 283 pages. ISBN 0-07-024205-4. RRP $59.95 (Hard cover version ISBN 0-07-024204-6, RRP $89.95).

Digital satellite TV broadcasting has only been going in the USA for a little over a year, but has by all accounts made an enormous impact. Apparently huge numbers of cable TV subscribers have swung over to DSS, causing the cable TV companies to refer to the new satellites as 'Death Stars'. This book is intended to provide technicians and advanced hobbyists with sufficient information on the new DSS receiving systems to allow them to install and maintain them with confidence.

Author Goodman provides a couple of introductory chapters with satellite TV history and the development of DSS, and then dives into the 'nitty gritty'. There are chapters on DSS operating principles, installing a receiving setup, distribution systems, troubleshooting and so on.

It's all quite practical and informative. However as DSS hasn't arrived in Australia as yet, this kind of book is going to be of less value here than in the USA — for a while at least. For readers in this area its primary value at present would be as a glimpse of what we *might* see here sometime in the future. But if you would like to learn more about DSS and what it offers, this book is worth considering as a primer.

The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.)

Basic reference

PRACTICAL ELECTRONICS HANDBOOK, Fourth Edition, by Ian Sinclair. Published by Butterworth-Heinemann (Newnes imprint) 1995. Soft covers, 164 x 234mm, 439 pages. ISBN 0-7506-2168-0. RRP $35.95.

This is the fourth edition of this title, the original dating back to 1980. The third edition was produced in 1992, with this edition following less than three years later — giving an indication of how rapidly electronics is changing. According to the author, the book contains, in a reasonable space, most of the information that is useful in day-to-day electronics. It provides brief explanations intended to serve as reminders, rather than full descriptions.

It contains a wide range of circuits and over 40 pages of digital IC pin-outs. A major addition to the book is a chapter on energy conversion devices, sensors and tranducers, including familiar and less familiar devices.

There are 11 chapters in all, along with an extensive appendix. Topics covered include passive components, active discrete components, an overview of commonly used circuits, linear and digital ICs, microprocessors and digital data transfer. It also has a chapter on using computers as a design aid, and another on hardware — which looks at connectors, cables, switches, cases, component packaging, breadboarding, soldering, troubleshooting and so on.

The chapter on circuits includes typical audio circuits (magnetic pickup preamplifier, filters, output stages etc), oscillator circuits, both audio and RF, optical circuits and power supplies. General circuits are given in the chapter describing linear ICs, which also covers phase-locked loop devices, voltage stabilisers and the venerable 555 timer.

The book is well illustrated, and in the opinion of this reviewer is excellent value. It has a lot of information that should prove useful to anyone working with electronics. The review copy came from Butterworth Heinemann, PO Box 146, Port Melbourne 3207. (P.P.)

AAEC history

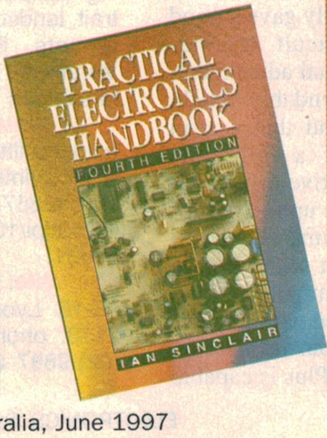
AUSTRALIA'S URANIUM OPPORTUNITIES, by Keith F. Alder. Published by Pauline Alder, 1996. Soft covers, 266 x 183mm, 88 pages. ISBN 0-646-29942-5. RRP $20 including postage.

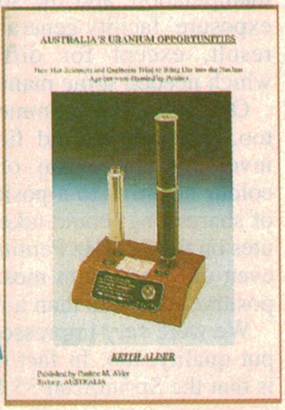
An interesting little book, not strictly electronic in terms of subject matter but probably of considerable interest to many of our readers with a scientific bent. Until his retirement author Keith Alder was chief executive of the Australian Atomic Energy Commission (AAEC) from 1975 until 1982, and before that had been Director of the Lucas Heights research establishment from 1962. He's also a radio amateur, by the way, with callsign VK2AXN.

His basic goal in writing the book seems to have been to provide an eyewitness account of the chequered history of the AAEC, written from the standpoint of a technologist who worked within the organisation, and for much of the time running it. The idea is to correct what he sees as many mistaken ideas about why things were done, why mistakes were made and opportunities lost; and in his view the bottom line seems to be that most of the problems were the result of politics and interference by politicians and anti-nuclear lobbyists.

It's not a happy story, as he admits. But it does make interesting reading, and is probably an essential reference for anyone seeking a balanced and thorough understanding of Australia's achievements — both positive and negative — in the area of nuclear science and technology.

Copies are available from the publisher, Pauline Alder, at 2 Eulbertie Avenue, Warrawee 2074. (J.R.) ❖





LASER LIGHT SHOW

It's not often we review a kit of parts, but this kit is for a laser light show. To do it justice, we built it up from the supplied instructions. Read on to see how effective the final result is and whether we had any problems building it.

by PETER PHILLIPS

The development of the laser diode has brought about an increased interest in applications for laser beams. Compared with a gas-filled laser tube, these devices cost a lot less, and don't need complex high voltage circuitry to drive them. So, like most electronics magazines, we have presented a number of laser-based projects in recent years — most of which have come from Oatley Electronics.

In this review, we are looking at a kit of parts for a 'laser light show' from Oatley Electronics, in which a laser beam traces an almost infinite range of patterns onto a wall or any surface. The original version of this kit has been around for some time, but this new kit has several enhancements claimed to make construction easier, and to give a wider range of patterns.

We first looked at a completed example, but decided that the only way to review a kit was to actually build it. However, spending time with a completed version first allowed us to consider a few modifications that could be easily added to enhance its performance. It also gave us an idea of what the final results should be, which we found to be most impressive.

Of course, the main application of a laser light show is for entertainment. And it fulfils this remarkably well. For example, we found it gave a bright and entertaining display capable of covering the wall of a two-storey house. The patterns are random, and include expanding circles that give a 3D tunnelling effect, star patterns, rotating flowers and so on. In fact, we found it almost compelling, spending more time than we should have just watching one amazing pattern after another. Certainly a great addition to a party, a disco or just for pleasure.

Operating principle

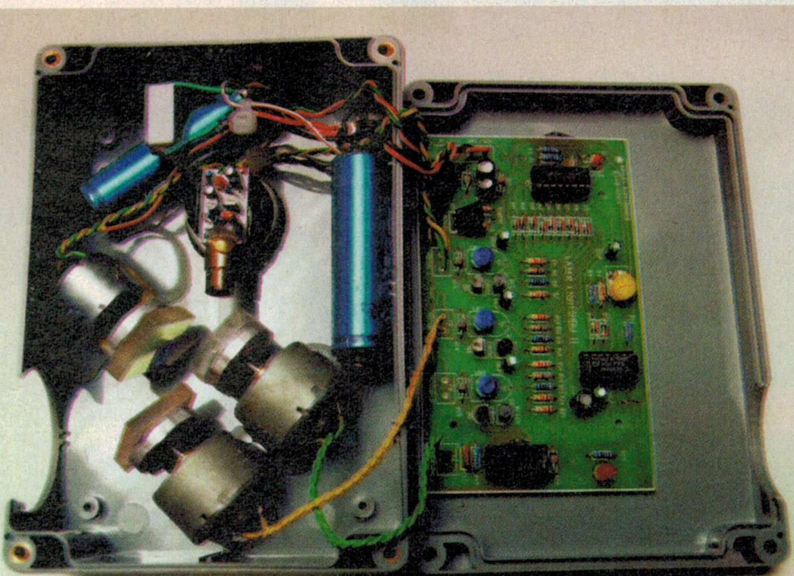
The light show comprises three main sections: a 5mW laser diode assembly, three 12V DC motors with mirrors attached to their shafts, and a printed circuit board containing the electronics to control the speed of each motor. The motors and the laser module are arranged so the laser beam hits the first rotating mirror which reflects it to the second. The second mirror reflects the beam to the third mirror, which then directs it out to a wall or other surface. Each mirror is glued to an aluminium back plate that in turn is glued to the shaft of the motor. The back plate is mounted so it's slightly offset, to give each mirror a 'wobble'.

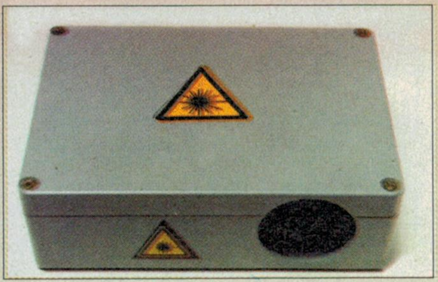
The motors each have eight different speeds, giving a total of 512 possible patterns. The speed of each motor is also adjustable, so varying the speed of any one motor brings about another 512 possible patterns. There is an adjustable delay of up to several seconds between each pattern.

The kit

The kit includes all the PCB components and PCB, a 5mW laser diode module, three motors, three mirrors and circular back plates. Depending on price, the laser module is either preassembled or supplied as a small kit you assemble yourself. Each back plate is drilled with a hole size slightly larger than the shaft of the motor, to give the required eccentricity. The fibreglass PCB is silkscreened and solder masked. A short set of instructions is included.

To complete the unit, you need to add a 12V DC power supply (or 12V battery) and a suitable box to contain everything. You also need epoxy glue and other glues





These shots show the kit as assembled by Oatley Electronics. The laser module here is the type that needs to be assembled. It also has lithium batteries instead of NiCads.

or methods of supporting the motors and the laser module. Otherwise, the kit has everything you need.

Building the kit

There are two separate tasks in building this kit: mounting the motorised mirrors and laser module to form the beam deflection unit, and building the electronics. The latter is much easier than the former.

The instructions suggest fitting the motors and laser module onto a plate that can then be fitted inside a suitable box. There are several suggested ways of supporting the motors, including hot melt glue or with metal brackets. The motors have two metric threaded screw holes on the front, although screws are not included.

We decided to build the deflection unit first, by mounting the motors on a piece of 3mm PVC plastic sheet. In hindsight, hot melt glue might have been easier, but we opted for metal brackets as the means of supporting the motors. The instructions give a suggested layout for the motors and laser module, but without dimensions.

The first task is to glue the mirror back plates to the shaft of the motors. The plates are drilled oversize so they can be mounted with a vertical offset of a few degrees, to give the required wobble. However, we found that the offset was just a bit too much, making alignment more difficult. If we built it again, we would reduce this offset. The mirrors are glued to the plates with epoxy glue.

Because of the excessive offset of the mirrors, we spent quite a lot of time aligning everything to give the required deflection. The metal bracket idea proved rather difficult due to screws working loose during the alignment process. The recommended hot melt glue is probably much easier. After spending several hours on it, we finally had the best alignment we could achieve.

Too much offset

The final display, although most effective, was a bit too large and eccentric, and there's one spot where the beam intensity is diminished. All because the offset was too great, and not adjustable. So if you build this kit, we recommend keeping the offset at around half the available amount.

We also found we had to power each motor in turn to effectively align the beam. Any DC power supply will do this, as the motors take very little current. The motors are nicely built and are only audible when running fast.

Because of our experience with an already assembled unit, we decided to mount all adjustments on a front panel to make it easy to adjust the unit to give another set of patterns.

The kit provides PCB mount pots, which we replaced with panel mount pots connected with ribbon cable to the PCB. We also added a switch to stop the clock advancing the electronics to another pattern. This lets you stop the unit when it reaches a particularly interesting pattern, and to fine tune it to whatever results you want. This switch connects between the point marked TP on the PC board and ground.

To make the light show portable, we also decided to include a 12V battery pack. Suitable battery packs are available from Oatley Electronics for around $5. The average current drain of the unit is about 140mA, giving several hours of use from a bank of AA NiCads.

These modifications, although easy to do, added about another hour to the construction time. The printed circuit board is nicely laid out and easy to complete. The electronics worked as described, and we had no problems getting it all going.

Final assembly

We fitted everything into a plastic box (200 x 60 x 160mm) we had on hand. We mounted the circuit board above the deflection unit, using 40mm pillars as spacers. This gave a compact assembly that merely needed a 12V DC supply, although in our case the pots were fitted to the box and not on the circuit board.

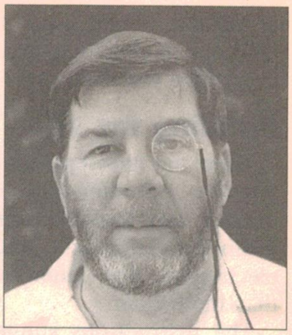
After final assembly it was simply a matter of entertaining ourselves and others with the unit. Despite the problems we encountered with the deflection angle of the mirrors, the final result was excellent. Having the external controls certainly increases the versatility, but they are not essential.

So in conclusion, this is a kit that while requiring some patience to build, gives results that are well worth the time spent building it. Our only criticisms are about the excessive deflection angle of the mirrors and that the instructions don't give guideline dimensions for placing the motors. We placed motors one and three virtually alongside each other, with motor two placed opposite and roughly central to the other two, with around 10mm between the face of the mirrors. ❖

The kit was supplied by Oatley Electronics, and has an RRP of around $100 to $150 depending on the type of laser diode module. For more information, contact Oatley Electronics, PO Box 89, Oatley 2223; phone (02) 9584 3563, or email oatley@world.net.

Moffat's Madhouse...

by TOM MOFFAT



A strange sound in the mist...

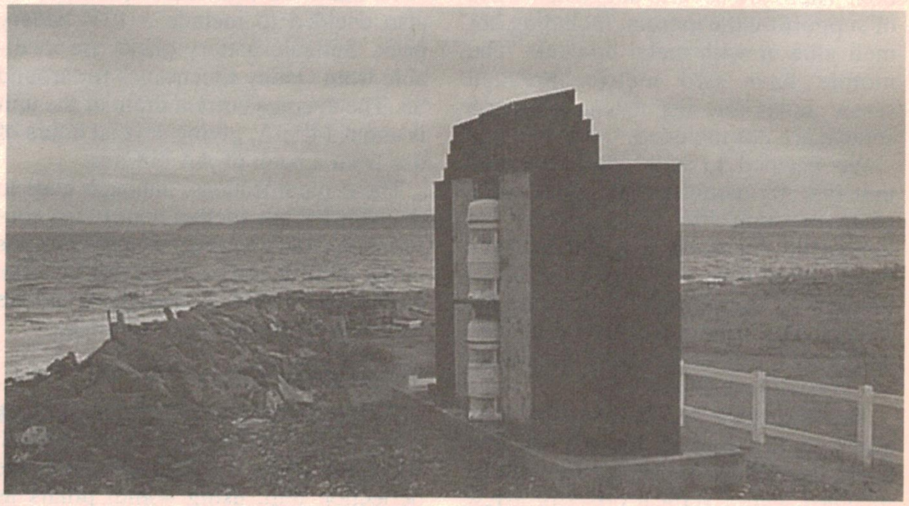
Sunday morning is supposed to be a time for sleeping in, right? Well, most days this is true, but on Sundays when there is fog about, all hell breaks loose in this coastal town where I live in the USA. The peace and calm is broken by the plaintive bleating of foghorns, expressing their disgust at the lack of sunshine.

Port Townsend is on the end of a peninsula, so the town is surrounded on three sides by the sea. It's maybe 4km from one side of the peninsula to the other. There are three distinct beaches, to the north, east, and south of town, and the beaches are separated by two prominent points — Point Wilson and Point Hudson. Each of these points has a powerful foghorn to warn ships away during the many pea-soup fogs that descend on the area.

The two foghorns sing an unholy duet of short notes every few seconds. The one at Point Wilson to the north has a soprano voice; the one at Point Hudson is a baritone. They do a call-and-response routine: "Oooooohhh!" from the baritone and "Eeeeeeee!" from the soprano. Totally out of sync, totally out of tune, each doing its own thing.

There is also a bell anchored on a buoy off the eastern beach, between the two foghorns. The bell is driven by the swell; as the buoy leans one way or the other, the clapper in the bell makes contact. So we now have a symphony of "Oooh, Eeee, Clang, Oooh, Eeee, Clang," in ever-changing order...

Some people would say these sounds are romantic. Just think of all the films made about San Francisco where the foghorns and clanging buoys are the dominant sound effects. Actually the noise *is* quite lovely at times. The east beach has access from Chetzemoka Park, a popular city park complete with adult-sized swings and an old-fashioned bandstand where they have band concerts in the summer. There's nothing finer than walking along that beach on a foggy night, hand in hand with a lovely woman, as things in the mist go clang and oooh and eeee. You can throw in a few seagulls for good measure.



A general view of the Point Wilson foghorn, taken with Tom's Epson PhotoPC 500 digital camera.

But NOT at 6:30 on a Sunday morning.

This weekend it happened again — a pea-souper with full sound effects. I lay there in bed wondering how anything as far away as those foghorns could be so loud. Especially the baritone. I thought about it some more, and eventually theorized that the low note was louder because low sound frequencies are less attenuated by distance. That of course assumed that all foghorns started out at the same sound intensity in the first place. More thinking — and then it was time for direct action. I decided to go find out for myself.

I hopped out of bed, climbed on my bicycle, and embarked upon a voyage of discovery.

The foghorn at Point Wilson is in a state park, hard up against a lighthouse complete with live-in keeper. Perhaps 500 metres away is a caravan park and campground. Surely all those happy campers would be up in arms with that thing unleashing deafening "eeee"s at so close a distance? And what about the lighthouse keeper, trying to sleep perhaps 50 metres from it? No wonder his dog barks all the time.

It was still pretty foggy on the way out to Point Wilson, and the foghorn was in full cry, even louder from the seat of a bicycle that it was from the comfort of my bed. But, as I got closer to Point Wilson, the sound level DECREASED! Eventually I lost it altogether, and I thought maybe the lighthouse keeper had turned it off. But there was still plenty of fog about. What gives?

I was inside the state park at last, heading along the road past the caravan park, and only the sound of the breeze whistling past my ears. Still no foghorn. But I pressed on, got to the lighthouse fence, leaned my bike against it and set off on foot around the lighthouse and onto the point where the foghorn was now plainly visible. And then I heard a tiny "eeee". I had to stop to hear it clearly — just the scuffing of my shoes in the gravel masked the sound.

As I got closer, the sound didn't get any louder, and I had to stop and listen from time to time to make sure the foghorn was indeed singing. Finally, not 20 metres from the the foghorn, the sound began to increase. At 10 metres it would have still be possible to talk over the noise. At this distance a sign was visible, fastened to a low fence surrounding the foghorn, warning not to pass any further. The device

within could emit an intense sound at any time, loud enough to damage hearing.

From this angle the foghorn looked like a concrete wall with metal bits fastened to each end and along the top. The overall structure was about as tall as a small house. I was approaching from the back, but when I got to the fence I began to circle around to the front of the structure. There was still not much force in the foghorn's voice — until I got to a critical point. And then it got LOUD!

This was one interesting instrument. In the middle of the structure, facing out to sea, were two white objects that looked like sirens, mounted one above the other. Each was about the size of a 44-gallon drum, and it appeared that only the top one was working; the other must have been a backup in case the top unit failed. I have no idea what powered them, but given the sound pressure I would be surprised if they were electronic. Compressed air? Some vibrating mechanism? Who knows. Suffice it to say, they made a LOT of noise.

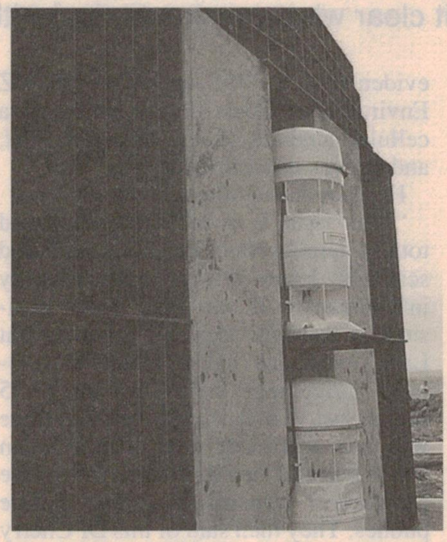
The interesting part was not the sound emitters themselves, but the metal bits surrounding them. These curved away symmetrically at the ends, and they were made up of a series of long rectangular chambers, obviously very carefully designed to a particular size. Along the top were square chambers.

What we had here was an acoustic lens. Its purpose was primarily to send as much sound pressure as possible out to sea; but just as important was the null toward the back. The foghorn was in close proximity to hundreds of sleeping people in the caravan park, and the campground, and the lighthouse. And in those places it was absolutely silent. Yet, four kilometres away, that same foghorn was capable of jolting me out of my own bed.

You electronics people can probably visualize this acoustic lens as an antenna, with a particular radiation pattern. Or perhaps as a microphone with a cardioid pickup pattern. And, doing a simple walkaround test of the shape of the null, it became pretty obvious we had a cardioid foghorn. I am no acoustics expert, but it seems those metal slots were like antenna elements, carefully tuned to the operating frequency. I suspect all of them working together produced phase reinforcement and cancellation, resulting in a very predictable, and efficient, radiation pattern.

But there seemed to be a fly in the ointment. If these foghorns are meant to be radiating directly out to sea, The baritone foghorn at Point Hudson should be mounted at a particular angle. In that case, the location of my home should be right off the back of it. Yet the baritone foghorn has always been the loudest. So it was time to investigate the Point Hudson foghorn, which was still clearly audible from Point Wilson. It was back on my bike for another journey...

During this trip there was no variation at all in the intensity of the baritone foghorn, even though I should have been slipping into its null. It was still tooting away happily as I arrived at Point Hudson. Here there is another caravan park, along with various shops, restaurants, and coffee bars. The foghorn isn't just near, it is IN the caravan park. What do those people think, when they pay their money for a good night's sleep, and have to put up with its "Oooooohhh" all night?



A closer view of the foghorn.

As I approached the Point Hudson foghorn, the penny dropped. The sound wasn't coming from it at all, but from out to sea. The Point Hudson foghorn was another soprano version, but singing double instead of single notes: "Eeeee — eeeee"! I had never heard it before, which makes sense since I live right in its null. This foghorn was of a much simpler design; instead of an acoustic lens it had two large sheets of plywood mounted so as to form a vee-shaped reflector. But it seemed to work well; the sound level, even at the nearest caravan, was minimal.

As for the baritone foghorn, still bellowing away, it could only be coming from Whidbey Island — about 10km across the water. Whidbey is an area of nice houses, reachable from Port Townsend by a car ferry service. If the foghorn is pointing directly out to sea, Port Townsend would be in the peak of its radiation pattern, which explains why is makes such an enormous racket in our little town.

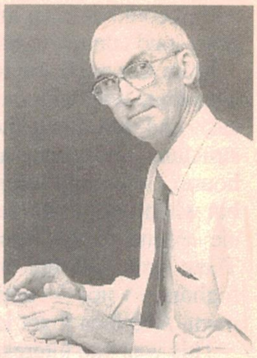
At this stage I decided the great foghorn saga deserved a place in the Moffat's Madhouse column, and I needed some pictures, preferably of the impressive Point Wilson structure. But there was no way I was going to go around in front of it and get my eardrums busted. So I waited until the fog lifted and the foghorns fell silent, and then headed back to Point Wilson. Whidbey Island was easily visible, so I was able to pick out a spot directly in the line of fire from the foghorn.

Later I plotted a classic cardioid pattern on a map, centred on the foghorn and oriented so the main lobe pointed across the water to the point on Whidbey Island that I'd eyeballed earlier. Then it turned out that my house was indeed within the edge of Point Wilson's radiation pattern. So that explains why I can hear that foghorn so clearly, yet it disappears as I move into its null.

All the time I lived in Tasmania, I never once encountered a foghorn, other than the ones carried aboard ships. I wonder why? There certainly is fog there, but Hobart is on a river estuary, rather than the open sea. Maybe that's it. However, if there are foghorns where you live, it might be fun to go foghorn snooping some foggy morning. Maybe your misconceptions about what foghorn lives where will be totally blown apart, as mine were. ❖

FORUM

Conducted by Jim Rowe



Don't listen to those FOOLS calling 'caution' in the telecommunications jungle!

As I noted in last month's column, the EM fields/health risk debate continues to escalate, and has virtually forced its way back into our attention. Although there's a veritable barrage of material on the topic clamouring for attention, there was a particularly unsavoury scene recently in the Australian Senate which made it clear what we should deal with this time.

You may recall that in earlier columns discussing the EM fields/health risk debate, we've quoted material from New Zealand scientist Dr Neil Cherry. Dr Cherry is Director of the Climate Research Unit at Lincoln University in Christchurch, and has made a long-term study of the environmental effects of electromagnetic fields; he has also been called before a number of court and council hearings in NZ, as an 'expert witness' on the health impact of cellular radio transmitting antenna towers. He has published various papers and reports on the subject.

Anyway, Dr Cherry visited Australia for a few days in early March, to speak at a couple of conferences and promote a new review he's made of the current scientific literature, entitled *Potential and Actual Adverse Effects of Radiofrequency and Microwave Radiation at levels near and below 2uW/cm²*. At the invitation of Australian Democrats leader Senator Kernot, he also gave a lunchtime talk to the Senate on March 5, on the same topic.

Later that day, in response to a 'Dorothy Dix' question from one of his colleagues, Minister for the Department of Communications and the Arts (DOCA) Senator Richard Alston made what can only be described as a 'hatchet job' attack on Dr Cherry and his reputation, under the protection of parliamentary privilege. As recorded in Senate Hansard he described Dr Cherry as a 'charletan', whose credentials supposedly begin with 'mindless and irrelevant gobbledygook' — apparently because they refer to him as having specialised in subjects such as solid state physics, and electron spin resonance spectrum changes with exposure to microwaves.

Senator Alston also made a point of noting that when Dr Cherry gave expert evidence at a 1995 appeal to the NZ Environment Court on the siting of a cellular antenna tower, "his side lost, and he was discredited by the Court."

Here are some other choice excerpts:

"This man is a rabid populist and totally uninterested in any considered scientific debate. His remarks are highly inflammatory. If one looks at the decision of the New Zealand Environment Law Court, one will see that in a 43-page judgement handed down on 5 March last year the court held that there was not sufficient basis for concern about harmful health effects from base transceiver transmissions for mobile phones. They then said of this Dr Cherry that he had maintained that scientists in the thermal school were burying their heads in the sand."

"The court said that other expert witnesses did not support his claim about two schools of thought."

Standards bias?

He went on to add "This individual addressed a conference in Sydney yesterday. He is quoted as saying — if he has been wrongly reported in the *Sydney Morning Herald*, I am happy to accept it — that the Australian Government had allowed the telecommunications industry to set standards for electromagnetic radiation from towers. The fact is that there is a joint Australian-New Zealand standards committee which sets these standards for both countries. It consists of 24 members and only two of those represent telecommunications carriers. So his comments were a grotesque misrepresentation of the standard setting process..."

"He is not interested in the facts. The facts are that the United Kingdom department of health recently published a national study which concluded that people living close to radio or television transmitting masts are not at increased risk of developing leukemia. Dr Cherry simply refuses to take notice of that. This man is not interested in the facts. It is very dangerous for the Australian Democrats to associate themselves with such a snake oil merchant..."

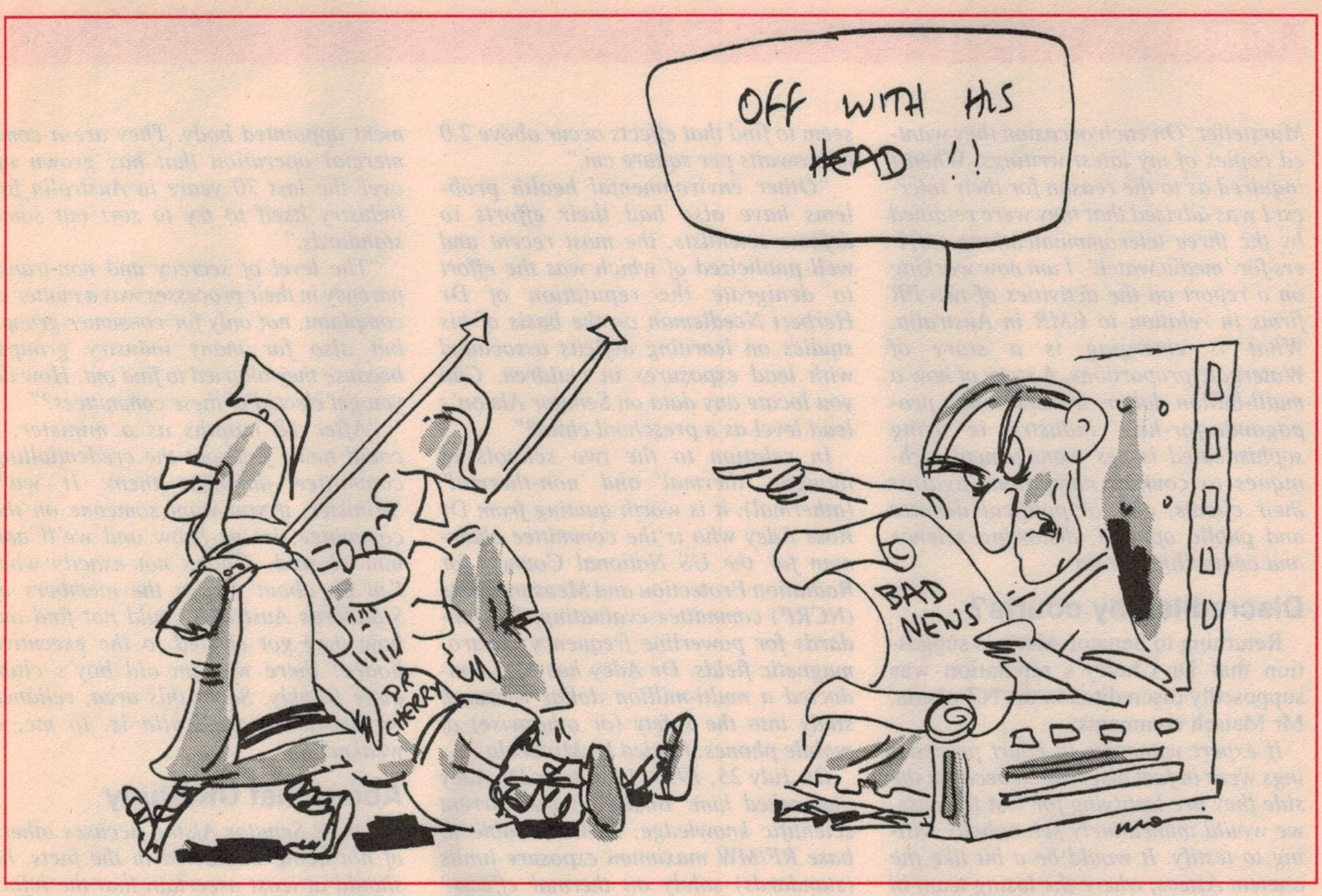
And in response to a further Dorothy Dixer, about what action the Government was taking to ensure that the Australian public is not misled on this important issue:

"That is precisely why we have commissioned a $4.5 million program over the next five years to ensure that the government is well and truly up to date with international experience. There is absolutely no evidence to support these scare campaigns and they have been discredited in the courts."

"The fact is we do have standards set by an impartial body. They are amongst the most stringent in the world. We are seriously concerned about the issue and that is why we are conducting further research. We are in close contact with the World Health Organization. We want to make sure that our citizens are protected."

"We want sensible discussions on a scientific basis, not emotional nonsense that will only mislead people into fearing that there is a problem when there is not on the evidence to date."

Now like myself, I suspect many *EA* readers will be inclined to think that some of Senator Alston's remarks reveal more about his own poor scientific understanding and political bias than they do about the credibility of Dr Cherry. They certainly show a fairly transparent attempt to discredit the reputation of one of the people urging caution with regard to the EM fields/health issue, in the hope of discrediting their message as well.



One can't help but feel that DOCA and the mobile phone industry must be getting rather worried about the levels of concern being expressed regarding the possible health risks of EM fields, and the support by scientists like Dr Cherry, to start responding at this kind of character assassination level.

The same point has since been raised in an e-mail report by Tasmanian activist Don Maisch, who has also contributed to this column on various occasions in the past. Don runs the EMFacts Information Service in Hobart, you may recall, which seeks to provide people with much of the information that certain authorities are tending to 'sweep under the carpet'. Nowadays he also publishes a quarterly newsletter called *Electromagnetics Forum* — more about this later.

Actually Don's latest e-mail in response to Senator Alston's March 5 outburst provides quite a lot of interesting reading, and because I believe it's in the public interest that this matter be given serious consideration rather than being relegated to the level of 'slanging matches' in the Senate, I've decided to reproduce some of it here.

Near the start, Don makes the following comment on Senator Alston's outburst: *The attack on Dr Cherry is a classic case of attacking the messenger and hoping to discredit the message by doing so. Senator Alston's action sends a clear message to scientists in Australia: 'Dare speak out against the interests of the telecommunications industry, and your reputation will be attacked in the Senate.' DOCA policy is apparently totally under the control of the telecommunications industry.*

The Democrats the other day received some new confidential information from inside DOCA, written by a concerned public servant. Here are a few excepts: 'DOCA is preparing a press release with the main intent of denigrating the credibility of Dr Neil Cherry. This document also attempts to present a weakened position for CSIRO by quoting that CSIRO believes that there is absolutely no health risk associated with telecommunications technology. This is a misrepresentation of the conclusions of the 1994 Report, which clearly stated that the data is too incomplete to make sound judgements. There is a growing mass of literature showing effects at exposure levels where thermal effects would not be expected. Exposures from mobile phone handsets are close to, if not above, so-called safety standards for RFR.'

With regard to DOCA's announcement of a research study into the health risks of EM radiation, the same document notes:

'The total funding of $4.5 million over five years is intended to cover the costs of public relations campaigns, travel to WHO meetings, glossy brochures for public information and the NH&MRC costs involved in advertising for research proposals, peer-review and administration of grants.'

From the sound of this, not much of the $4.5 million will be for actual research. I have heard from a reliable source that only a figure of $750,000 is for actual research. The figure of $4.5 million spread over five years for 'research' into health effects from EMR is a disgrace, when compared to the approximate $1 million in foreign aid given every day to New Guinea alone!

Neil Cherry's latest report should prove very useful. From the way the telecommunications industry and the Australian Government's departments are acting in unison, it is becoming apparent that the policy for both is being orchestrated by one or two transnational public relations firms.

I have been contacted on several occasions by the PR firm of Burson

Marsteller. On each occasion they wanted copies of my latest writings. When I inquired as to the reason for their interest I was advised that they were retained by the three telecommunications carriers for 'media watch'. I am now working on a report on the activities of two PR firms in relation to EMR in Australia. What is emerging is a story of Watergate proportions. A story of how a multi-billion dollar, transnational, propaganda-for-hire industry is using sophisticated issues management techniques to counter campaigns against their clients, control political debates and public opinion, distorting science and controlling media.

Discredited by courts?

Returning to Senator Alston's suggestion that Dr Cherry's reputation was supposedly discredited in the NZ courts, Mr Maisch comments:

If expert witnesses in court proceedings were in fact discredited because the side they are testifying for lost the case, we would immediately see nobody willing to testify. It would be a bit like the ancient Aztecs, where the losing team in their soccer matches were then sacrificed! What Senator Alston does not say, however is that this same court did enact one of Dr Cherry's main recommendations — The Precautionary Principle — and imposed a limit of 2uW/cm² at any dwelling. This is 100 times less than the current limit set by Standards Australia of 200uW/cm².

On March 12th, I contacted Professor John Goldsmith in relation to this New Zealand court case and what its findings were. Dr Goldsmith is head of the Epidemiology and Health Services Evaluation Unit, Faculty of Health Sciences, Ben Gurion University, Israel. He is author of a paper titled: Epidemiologic Evidence of Radiofrequency Radiation (Microwave) Effects on Health in Military, Broadcasting, and Occupational Studies. Dr Goldsmith also presented evidence at the New Zealand hearing referred to by Senator Alston. His reply is as follows:

"Such apoplectic remarks under privilege are already evidence of some well targeted probes..."

"I, too, was an active participant in the Christchurch hearing and feel that the Review Board, without saying it was doing so, accepted our advice. The current studies of leukemia and TV towers seem to find that effects occur above 2.0 microwatts per square cm."

"Other environmental health problems have also had their efforts to defame scientists, the most recent and well publicized of which was the effort to denigrate the reputation of Dr Herbert Needleman on the basis of his studies on learning deficits associated with lead exposures in children. Can you locate any data on Senator Alston's lead level as a preschool child?"

In relation to the two schools of thought, 'thermal' and 'non-thermal' (athermal), it is worth quoting from Dr Ross Adey who is the committee chairman for the US National Council for Radiation Protection and Measurements (NCRP) committee evaluating the standards for powerline frequency electromagnetic fields. Dr Adey has also conducted a multi-million dollar research study into the safety (or otherwise) of mobile phones, funded by Motorola.

On July 25, 1995, I wrote to Dr Adey and asked him: Based on the current scientific knowledge, is it advisable to base RF/MW maximum exposure limits (standards) solely on thermal effects? His reply, received in early August 1995 was as follows:

"You ask about exposure limits based solely on thermal effects. The laboratory evidence for athermal effects of both ELF and RF/Microwave fields now constitutes a major body of scientific literature in peer-reviewed journals. It is my personal view that to continue to ignore this work in the course of standard setting is irresponsible to the point of being a public scandal".

Moving on to the question of whether Dr Cherry was wrong to claim that the Australian Government had allowed telecommunications carriers to set standards for EM radiation from cellular radio towers, Don Maisch quotes from Shadow Minister for Communications, Senator Chris Schacht, 14 February 1997 on the Environment, Recreation, Communications and the Arts Legislation Committee:

"My own experience with Standards Australia leads me to have a very cautious view about any information they have about their processes. That is one of the reasons in 1994 I commissioned the Kean review on standards in Australia — to deal specifically with the endless complaints about the operation of Standards Australia, which are not a government statutory body or a government appointed body. They are a commercial operation that has grown up over the last 70 years in Australia for industry itself to try to sort out some standards."

"The level of secrecy and non-transparency in their processes was a matter of complaint, not only for consumer groups but also for many industry groups, because they all tried to find out: How do you get elected to these committees?"

"After 18 months as a minister, I could never find out the credentialling committee amongst them. It was: 'Minister, if you want someone on the committee, let us know and we'll add him'. I said, 'That's not exactly what I'm on about'. Even the members of Standards Australia could not find out how they got elected to the executive board; there was an old boy's club, quite frankly. So in this area, reliance on Standards Australia is, to me, a weakness..."

About that UK study

Before Senator Alston accuses others of not being interested in the facts, he should at least ascertain that the information given to him is factual. Unfortunately this is not the case. I faxed Senator Alston's statement to Professor Ivan Beale at the University of Auckland, New Zealand. Dr Beale is a committee member on the joint Australian/New Zealand Standards Committee for the current RF/MW standard, AS2772-1 1990. Here is Dr Beale's reply (5/3/97):

"The UK study referred to by Senator Alston was not published by the UK Department of Health. In fact there are two studies, not one. The authors are Dolk et al., and both are published in the American Journal of Epidemiology, Vol 145, 1997. In fact, both studies found a decline in risk with increasing distance from a transmitter, for adult leukemia. Additionally, one study (Sutton Coldfield) found an significantly elevated risk for adult leukemia within 2km of the transmitter, whereas the other study (multiple sites) did not. These findings seem inconsistent with the Senator's statement."

"Several of Senator Alston's statements could be fairly summarised as saying something like this: "The responsible science-based view is that there is no scientific evidence that radiofrequency radiation associated with telecommunications and broad-

casting places the public at risk for adverse health effects".

"My comment is this: Any competent literature review would conclude that there is substantial evidence of biological effects in animals and cell cultures and of adverse health effects in humans, of exposure to RF fields too weak to produce significant heating. Protection standards have not been based on this evidence, because it is not yet sufficiently coherent to yield thresholds for adverse effects. In my view it is irresponsible to say that this evidence is unscientific or unsubstantiated, and it is irresponsible to say that this evidence proves that the public are at risk."

"What is responsible, is to say that there is legitimate reason for concern, and that we should adopt a precautionary approach until such time as the evidence is more coherent. It's a pity that the debate reported in this hansard was not more responsible and balanced in its consideration of this issue."

The first study by Dr Helen Dolk was around the Sutton Coldfield TV and FM tower operated by the British Broadcasting Corporation (BBC). The incidence of leukemia was twice the expected rate. The risk declined with distance from the tower, and a statistical analysis indicated that the odds of this happening by chance were one in a thousand.

In her second study this association was less clear. This study looked at 20 transmitting towers, to see if there was a correlation with the first study. Most of the cases in this study were clustered around a single tower at Crystal Palace in South London. This tower has a similar power output as the Sutton Coldfield facility, but does not include a high power FM transmitter. Dolk counted 62 adults with leukemia within 2km of the Crystal Palace tower, but only 17 cases at the same distance from the other 19 towers.

Importantly most of these 19 towers were located in sparsely populated areas, and some did not include high power FM transmissions. When Dolk categorised the 20 towers which had high power FM transmissions or a combination of high powered FM and TV transmissions, she found a significant decrease in risk of leukemia with distance from the towers. However because of the low number of cases an association was weak, and Dolk concluded "The results in the second paper do not point strongly to an effect of transmission... and certainly not to differences between frequencies." (Information courtesy Microwave News, Jan/Feb 1997)

It is interesting that nowhere in Senator Alston's statement does he refer to the Sydney TV tower study, which also found a significant increase in leukemia around the towers. With this, and other previous studies pointing to similar conclusions, Mr Alston's and his department's (DOCA) apparent disinterest in the health implications of these studies is astounding.

Misleading people?

Don Maisch rounds up with some comments about Senator Alston's suggestion that anyone urging caution about the EM fields/health question was guilty of spouting 'emotional nonsense', and supposedly misleading people:

Emotional nonsense, misleading people, no evidence to date? In relation to mobile phone usage, heavy users of mobile phones may have some justified fears after reading the following, regardless of Senator Alston's claims.

In the March 3rd 1997 issue of Radio Communications Report, a US telecommunications industry magazine, in an article by Jeffrey Silva entitled 'Motorola memo raises questions about WTR research', Industry spokesperson Michael Volpe makes a significant admission. Mr Volpe is spokesperson for the Cellular Telecommunications Industry Association's (CTIA) Wireless Technology Research L.L.C. (WTR). WTR was set up to conduct RF/MW cancer research and is funded by CTIA industry members. Mr Volpe was replying to accusations that the CTIA's Scientific Advisory Group (SAG, a forerunner to WTR) and WTR were part of a conspiracy to conceal adverse scientific evidence.

"In fact, the SAG and WTR have repeatedly made public statements which confirm the contention that existing data and studies do not rule out the possibility that cellular telephones cause ill health effects such as brain cancer."

The research of Dr Henry Lai and Dr Narendra Singh, reporting single and double-strand DNA breaks in rats exposed to low level RF energy at 2.45GHz after a single two-hour exposure, have been proving a headache for Motorola. An internal Motorola memo, leaked to the New York based Microwave News, discusses ways on how to handle this potentially very damaging research for the mobile phone industry.

In the same Radio Communications Report article, Lai said he wasn't surprised by the Motorola memo. Asked whether he believes pocket phones (cel-

lular phones incorporating the antenna in one unit) pose a health risk, Lai answered: "It's alarming... ...I'm just waiting for the time to tell the truth."

Considering the above, it would perhaps be more accurate to restate Senator Alston's last statement as thus:

We want sensible discussions on a scientific basis, not on contrived pro-industry biased information that will only mislead people into believing there is not a potential health problem, when available scientific evidence indicates otherwise.

Hmmm — food for thought, don't you think? My thanks to Don Maisch for sending me this information, and I trust it will help at least EA's readers put things into perspective. It's pity that the debate has descended to the personal attack level, all the same.

By the way, Don Maisch sent me a copy of the first issue of his new quarterly publication *Electromagnetics Forum*, which seems to be a very nicely produced and informative roundup of news from around the world regarding EM radiation and health. If you want to keep up with developments in this important area (which are often not reported in the mainstream media), it's well worth considering. The cost to subscribe is $48 per year, plus overseas postage where applicable.

Don apparently also has available copies of Dr Cherry's new review paper, as mentioned earlier in this column. It's entitled 'Potential and Actual Adverse Effects of Radiofrequency and Microwave Radiation at levels near and below 2uW/cm^2' — although Don says he's thinking of renaming it 'the report the Australian Government doesn't want you to read'. It runs to 123 pages and is available for A$14.00 plus air mail postage.

For both the newsletter and the report enquire to EMFacts Information Service, PO Box 96, North Hobart 7002; phone (03) 6243 0195, or fax (03) 6243 0340. Don Maisch can also be contacted on e-mail at **EMFacts@tassie.net.au.** Note that this is his new address, different from the one we've given before. ❖

Mars Pathfinder

(Continued from page 21)

The lander's first task will be to transmit engineering and scientific data collected during its descent to the Martian surface. If no errors are detected in this data, a real-time command will be sent from Earth instructing the lander to unlock the imager camera head, deploy and point the high-gain antenna on its pop-up mast, roll out the two rover exit ramps and unlatch the Sojourner rover.

The lander's camera will then take a panoramic image of the Martian landscape and begin to transmit the data to Earth at a rate of a few thousand bits per second. The first images of the Martian landscape, which should be returned to Earth within 35 minutes of the start of the primary mission, will show scientists whether the petal on which the rover sits is flat against the surface or tilted against a rock. The image will also show the terrain beyond the rover exit ramps, so scientists can decide which route looks safer. It is expected that these images will be posted onto the Internet as soon as possible and will be seen at **http://mpfwww.jpl.nasa.gov**.

Once the decision is made on the route to be taken, commands will be sent to deploy the Sojourner, which will spend an hour exiting its ramp. Driving off onto the floor of an old outflow channel, Sojourner will explore the surface at the command of Earth-based operators, who will rely on lander based images to select a path and target for the rover. The Sojourner will be travelling at 1cm/s performing mobility tests, imaging the surroundings and deploying the alpha proton X-ray spectrometer.

The primary mission will last seven Martian days (or 'sols') for the rover and 30 Martian sols for the lander. Sojourner may carry out an extended mission beyond that period, depending on how long its power sources and electronics last. Engineers expect that the most probable reason for its stopping will be hot-cold cycling of onboard electronics. For the lander, an extended mission lasting up until July 1998 is possible.

Now that NASA has embarked on a comprehensive Martian robot program, we now wait and see how long it takes before humans step foot on the red planet.

In conclusion, the author wishes to thank Colin Burgess and Deb Dodds of the Johnson Space Centre; Dr Ken Edgett of Arizona State University; Mary Hardin of the Jet Propulsion Laboratory and Louis Kourtidis for their assistance in the completion of this article. All photos are courtesy of NASA. ❖

ALL NEW PRODUCTS & GREAT SPECIALS

Plustek OpticPro 4800p

24-BIT 16.8 MILLION COLOUR *SINGLE-PASS* FLATBED SCANNER *600 dpi resolution*

- 24-bit, 16.8 Million colours
- 600dpi, 4800 dpi interpolated
- A4 scanning area
- Parallel port, no jumpers to fiddle with!
- Software included for Optical Character Recognition (OCR) photo editing and multifunction document processing such as faxing and copying

NEW

X19912 **$327** TAX EX

$379 TAX INC

PLEASE LOGON TO- http://www.rie.net.au for full specs for this scanner.

MONITOR SPLITTERS

VGA MULTIPLIER

4 WAY MONITOR SPLITTER
Connect 4 VGA monitors to 1 computer. Great for seminars, presentations, and schools.
X19167 **$275**

8 WAY MONITOR SPLITTER
Connect 8 VGA monitors to 1 computer. Simultaneous display.
X19165 **$399**

HOT SPECIALS

MODEM SALE

33.6K bps Internal	$139
33.6K bps External	$159
33.6K bps Int. Voice/Fax modem	$169
33.6K bps Ext. Voice/Fax modem	$179

All Modems Austel Approved
50 hours FREE Internet access when you purchase your modem from us!
(Ask for Conditions)

ETHERNET CABLES

For networking installation using BNC 50 ohm coax cabling that are preassembled ready-to-use cables with BNC connectors at both end.

BNC 50 ohm Network Cables:

Cat No.	Length	Price
P37700	500mm	$5.95
P37701	1m	$6.95
P37702	2m	$6.95
P37703	3m *Male-Male*	$8.95
P37705	5m *Male-Male*	$9.95
P37710	10m *Male-Male*	$12.95
P37715	15m *Male-Male*	$16.95
P37720	20m *Male-Male*	$19.95
P37730	30m *Male-Male*	$34.95
P37740	40m *Male-Male*	$44.95
P37750	50m *Male-Male*	$59.95

A4 LAMINATOR

LATEST A4 SIZE LAMINATOR

you can protect and preserve your favourite documents **- up to A4 size,** business cards, recipes, membership cards, and other types of paper thin objects in a waterproof, airtight seal.

$169 A91101

A91118 216 x 303mm (A4) **$89.00** PKT100
A91119 216 x 303mm (A4) **$12.95** PKT10

Microsoft Office 97

ALL BRAND NEW!

- MS PowerPoint 97
- MS Outlook 97 • MS Excel 97
- MS Access 97 • MS World 97

PLUS **50 hours FREE Internet Access** - (Conditions Apply)

- **Full Version** $685
- **Professional Upgrade** $439
- **Standard Upgrade** $339

**MS Access is not included in the Standard Upgrade version*

MONITOR RANGE

All on display at all Stores

• 14" N.I. 1024x768 (0.28mm D.P.) Full Scan	$279
• 15" XGA Digital Low Radiation 1280x1024	$379
• 15" XGA Digital OSD1280x1024	$399
• 17" XGA Digital MPRII 1280x1024	$829
• 17" XGA Digital MPRII 1600x1280 (0.26mm Dot Pitch)	$1295
• 20" XGA Digital MPRII *NEW!*	$1999
• 21" XGA FLAT SCREEN *NEW!*	$2795

OSD- On Screen Display
See our web site- http://www.rie.net.au for full specifications

CLICK MOUSE

- Dynamic & fast tracking
- Opto-mechanical encoder

1-9 **$9.95** 10+ **$8.95**

JOYSTICK

- Ultra-sensitive fire button
- Turbo & manual switch
- 5 ft cord

1-9 **$17.95** 10+ **$16.95**

SAVE! SAVE! SAVE!

5¼ H.D FLOPPY DISKS
1-9 .... **$3.50** 10+ **$2.95**

3.5" NO NAME BRAND HIGH DENSITY DISKS IN PACK OF 10s
1-9 .... **$4.95** 10+ **$4.75**

IOMEGA ZIP DRIVE

THE AFFORDABLE PERSONAL STORAGE SOLUTION

- 100MB Zip disks hold all your stuff
- Are inexpensive, reliable and ready to help you get organized
- Use as many disks as you need

Av Seek Time: 29msec

Available for IBM and Mac

Parallel Port version only CI1900 **$249**

100MB ZIP DISK CI1904
1+ **$24** 10+ **$22**

ALL NEW SOUND BLASTER RANGE:

X17348 SB 16 Value PnP/3D Sound	$159
X17350 SB 32 Pnp/3D Sound	$249
X17392 SB Value CD16/8x-*Octal*	$429
X17354 SB Performance CD32/8x-17	$499
X17404 SB AWE64/3D Sound	$299
X17364 SB Discovery CD32/Hex-Speed	$499
X17368 PCMIA 4x CD-ROM Upgrade Kit	$479
X17396 OEM PnP Vibra 16 with IDE	$109
X17394 OEM PnP Vibra 16 without IDE	$99
X17382 CD-Rom Writer 4210	$769

RITRON COMPUTER SYSTEMS

CPU TYPE (External 256K Cache)	TAX EX	TAX INC
K5-100	$960	$1171
K5-133	$1020	$1244
6x86-120/150P	$1010	$1240
6x86-133/166P	$1060	$1310
6x86-200P	$1190	$1490
Pentium™ 100*	$1010	$1230
Pentium™ 120	$1040	$1265
Pentium™ 133	$1085	$1320
Pentium™ 150	$1120	$1365
Pentium™ 166	$1280	$1595
Pentium™ 166MMX	$1390	$1690
Pentium™ 200MMX	$1710	$2085
Pentium™ Pro 150	$1550	$1891
Pentium™ Pro 180	$1900	$2318
Pentium™ Pro 200	$2050	$2500

8 MEG RAM • 1.2 GIG H.D.D.-*GREAT VALUE!* • 1.44 MEG 3.5 FDD • Mini or Baby AT casing • 2 SPG Ports • 104 Keyboard • 14" SUPER VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor • Systems now fitted with PCI video cards - Better performance value for the same price. • *16M of RAM, ATX case & P.S. for Pentium Pro system*

FREE 3 HOUR
TRAINING COURSE (MELB. ONLY) FOR ALL COMPUTER SYSTEMS INCLUDING MULTIMEDIA SYSTEMS

4 YEAR SYSTEM WARRANTY
Manufacturer's Warranty apply for Monitor
3 Months Consumables Warranty

★RITRON CLASSIC★

The ideal system for today's power-hungry users...

16x SPEED CD ROM DRIVE — 2.1 GIG H.D.D.

16/32* MEG RAM WOW!

- ★ ***16x-Speed CD-ROM drive***
- ★ ***16/32* MEG*** *FAST EDO RAM*
  **Pentium Pro's come with 32Mb of RAM*
- ★ ***Latest 430 VX M.B.*** (256K pipeline cache/Upgradable to 200Mhz cpu) $20 extra for 512K cache M.B. - *does not apply to Pentium Pros* ***- 430 HX M.B. $30 extra***
- ★ ***New 2 MEG Diamond Stealth 3D Virge Chipset Card***
- ★ ***15" XGA Digital Mon-*** 1280 x 1024 0.28mm D.P. Low radiation
- ★ ***2.1 GIGABYTE HDD***
- ★ **1.44 3.5" F.D.D.**
- ★ **Genuine Microsoft Ergonomic Mouse**
- ★ **Ritron Mouse Pad** ★**Joystick**
- ★ **Windows 95 104 Keyboard**
- ★ **16-bit Sound Card -SB compatible**
- ★ **Magnetic Shielded Speakers**
- ★ **Windows 95 on CD** (DOS & Windows 3.11 for Workgroup available on request)
- ★ **We install Vet OEM Antivirus software** $99 of bonus value

VIRUS CHECKED BY VET

★***BONUS 7 FREE CD SOFTWARE TITLES:* For Windows 95:** Microsoft- Works & Money/ Encarta 97/Golf /CD Sampler / Cinemania 97 /3D Movie Maker /Scenes on disk and Yellow & White Pages on CD-ROM

★***20 Megabytes FREE*** SHAREWARE GAMES

CPU CHOICES	TAX EX	TAX INC
6x86-120/150P	$1590	$1795
6x86-133/166P	$1650	$1895
6x86-200P	$1710	$1940
Pentium™ 100	$1580	$1815
Pentium™ 120	$1630	$1865
Pentium™ 133	$1670	$1910
Pentium™ 150	$1710	$1975
Pentium™ 166	$1790	$2050
Pentium™ 166 MMX	$1870	$2170
Pentium™ 200 MMX	$2190	$2495
Pentium™ Pro 150	$2300	$2650
Pentium™ Pro 180	$2550	$2895
Pentium™ Pro 200	$2750	$3100

Pentium Pro's come with 32Meg of Ram as standard with ATX style case and power supply All Pentium™ Motherboards come fitted with 256K Pipeline Cache.

100 Hours Free Internet Access From rie.net.au -
When modem & system are purchased together. Conditions Apply

★***NOW COMES WITH FREE*** MS Windows 95 CD tutorial

FREE HOME DELIVERY & SETUP- MELBOURNE METRO AREA ONLY

3 HOUR FREE TRAINING COURSE
Windows 95 OR Internet Training Classes available

4 YEAR PARTS & LABOUR WARRANTY

(FIRST 2 YEAR ON-SITE) MELB MET AREA
Manufacturer's Warranty apply for Monitor

ADD MORE MEMORY, POWER, AND HDD SPACE TO YOUR SYSTEM

SUPA MOTHERBOARD UPGRADES

	CPU	*M.B.	Both Together
AMD K5-100	$119	$145	$269
AMD K5-133	$199	$145	$319
6x86-120/150P	$179	$145	$299
6x86-133/166P	$249	$145	$389
6x86-200P*	$309	$189	$479

*512K Cache Motherboard

100MHz PCI/ISA	$309
120MHz PCI/ISA	$339
133MHz PCI/ISA	$349
150MHz PCI/ISA	$429
166MHz PCI/ISA	$559
166MHz MMX NEW!	$749
200MHz MMX NEW!	$1095
Pro 150MHz® PCI/ISA	$895
Pro 200MHz® AT MB	*$1295*
Pro 200MHz® ATX MB	*$1395*

MEMORY

MEMORY	1-9	10+
1M 30 pin	$15	$13
4M 30 pin	$59	$55
4M 72 pin	$45	$43
4M 72 pin EDO	*$39*	*$37*
8M 72 pin	$75	$69
8M 72 pin EDO	*$69*	*$65*
16M 72 pin	$159	$155
16M 72 pin EDO	*$129*	*$125*
32M 72 pin	$289	$279
32M 72 pin EDO	*$249*	*$239*

HARD DRIVES *Voice Coil IDE HD*

Capacity	Av.Access	Tax Ex.	Tax Inc.
1.0GB	12ms	$235	$286
1.27GB	10ms	$245	$299
1.6GB	10ms	$259	$315
2.1GB IDE HD	10ms	$279	$339
2.5GB IDE HD	10ms	$360	$439
3.2GB IDE HD	10ms	$375	$455
5GB IDE HD	10ms	$595	$725
FAST SCSI 3.5" HARD DISK	***DRIVES SPECIALS***		
2.1GB SCSI 2 HD	SPECIAL	$495	$599
3.2GB SCSI 2 HD	SPECIAL	$570	$689
4.2GB SCSI 2 HD	SPECIAL	$1495	$1800

MULTIMEDIA UPGRADE KIT

Octal-Speed	$299
10x-Speed	$329
12x-Speed	$339
16x-Speed	$369
18x-Speed	$389

With easy-to-follow installation instructions. All CD-ROM drives are Kodak PhotoCD® compatible. • 16-bit Sound Card • Stereo Speakers • Software titles: **For Windows 95:** Microsoft- Encarta'97/ Works & Money/Golf/ CD Sampler/ Cinemania 97/ 3D Movie Maker and Scenes on disk. *ALL NEW!!*

CD ROM DRIVES

8X-SPEED	$159
12X-SPEED	$169
16X-SPEED	$199
18X-SPEED	$219
8X-SPEED SCSI	$339

rie ROD IRVING ELECTRONICS PTY LTD

ESTABLISHED SINCE 1977. 100% AUSTRALIAN OWNED A.C.N. 005 428 437

HEAD OFFICE: 56 Renver Rd Clayton, Victoria, 3168 Ph: **(03) 9543 7877**

MELB CITY STORE: 48 A'Beckett St. City. Ph: **(03) 9663 6151.** Fax (03) 9639 1641 *Open 9am-8pm on Fridays.*

NORTHCOTE: 423 High St. Ph: **(03) 9489 8866** Fax:(03) 9489 8131

BOX HILL: 1031 Maroondah Hwy. Ph: **(03) 9899 6033** Fax:(03) 9899 0156 *Open 9am-3pm on Saturdays.*

VERMONT: 190 Rooks Rd. Ph: **(03) 9874 8888** Fax:(03) 9874 2288

OAKLEIGH: 240C Huntingdale Rd. Ph: **(03) 9562 8939** Fax:(03) 9562 8940

BLUESTAR COMPUTERS:

RINGWOOD 271 Maroondah Hwy. **Ph: (03) 9870 1800** Fax:(03) 9879 3027

TRADING HOURS: Mon/Fri 9am - 5.30pm.Sat 9am - 1pm

SPRINGVALE NORTH 899 Springvale Rd, **Ph.(03) 9574 6699** Fax.(03) 9574 6633

ADELAIDE: 241 Wright St. **Ph: (08) 8211 7200** Fax:(08) 8211 7273

SYDNEY: 74 Parramatta Rd, Stanmore. **Ph: (02) 9519 3888** Fax:(02) 9516 5024

MAIL ORDER: Ph:**(03) 9543 7877** Fax:(03) 9543 8295

Tax Exempt sales:

RITRONICS WHOLESALE Ph.**(03) 9543 2166** Fax.(03) 9543 2648

RIE BULLETIN BOARD Ph: (03) 9562 7877 For Specials, info & Shareware

World Wide Web Site: http://www.rie.net.au

E-MAIL: rie@rie.net.au

Mail Order Hotline 1-800 33 5757

Serving Australia Wide

ERRORS & OMISSIONS EXCEPTED. PRICING CHANGE WITHOUT NOTICE.

EAGG697

rie ROD IRVING ELECTRONICS PTY LTD

ESTABLISHED SINCE 1977

A.C.N. 005 428 437

ROD'S HOTLINE 1-800 33 5757

MAIL ORDER LOCAL CALLS: (03) 9543 7877

JUMPERLESS TX CHIPSET MOTHERBOARD

This motherboard utilizes the latest Intel's 82439 TX, PIIX4, 324 pin BGA chipset. It offers a highly integrated solution for fully compatible, high performance PC/AT platforms, and supports Intel Pentium, Cyrix 6x86 and AMD K5, K6 microprocessors. It features Write-Back Secondary Cache memory for 256KB/512KB in size. Flexible main memory size can be installed from 8MB up to 256MB DRAMS.

X18520 **$299** AT SIZE

AVAILABLE IN AT OR ATX FORM FACTOR

- **Chipset** -Intel 82439 TX, PIIX4, 324 pin BGA chipset. X18524 **$349** ATX SIZE
- **CPU** -Supports 75 - 200 MHz PENTIUM™, AMD K5 PR75-PR166+/K6 166/200KHz, Cyrix M1/8x86 and 6x86L CPUs. 2.8/ 2.9/ 3.2V circuit on board, ready for Pentium MMX and Pentium MMX compatible CPU support.
- **Memory** -Supports 4 x 72 pins SIMM modules and 2 x 168 pin DIMM modules.
- -64-bit data path for flexible memory size expanded from 8MB up to 256MB DRAMs for SIMM socket.
- -Support Fast Page mode DRAM and EDO DRAM for SIMM socket.
- -Supports from 8MB to 64MB 3.3V/unbuffered SDRAM DIMM or 3.3V/ unbuffered EDO DIMM for DIMM slot. DIMM ram is only available as 8/ 16/ or 32MB.
- **Cache Memory** -Provides 256KB/512KB Pipelined Burst Cache or DRAM Cache on board

TRIDENT 3D TV-OUT

NOW YOU CAN HOOK UP YOUR HOME TV FOR IMPRESSIVE MULTIMEDIA PRESENTATIONS OR JUST PLAY GAMES! (SEGA LIMITED PLAY TITLES INCLUDED)

X18240 **$119**

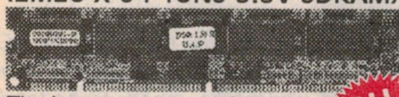
Logon to http:// www.rie.net.au for full details and specifications.

2MEG FITTED X18244 **$139**

Works with either 486 or Pentium™ Peripheral Component Interconnect (PCI) bus system to bring you high resolution, true colour capability, high performance, and compatibility with most software and hardware. • 64-bit high performance GUI accelerator • NTSC/PAL interlaced display for 640 x 480 (NTSC) or 800 x 600 (PAL) resolutions using standard Windows 3.1 and Windows 95 modes in all colour depths. • NTSC/PAL display for DOS games (320 x 240) • Only 1 MB DRAM for 1024 x 768 -256 colours • PCI Rev 2.1 compliant • Optimized 2D graphic engine • 24-bit packed true colour acceleration • Support 3D multimedia acceleration • WIN95 DirectDraw Acceleration • Direct interface to MPEG and Video Decoder

SDRAM DIMM

(2MEG X 64 10NS 3.3V SDRAM)



The latest memory technology for use with the latest TX Chipset motherboards. This is unbuffered RAM.

ALL NEW!

	1-9	10+
16Meg	$199	$189
32Meg	$359	$349

Sound Blaster AWE64 PnP GOLD

64-voice professional Wave-Table/WaveGuide Music. 4MByte of RAM for downloading high quality E-mu Wave-table GM Midi Bank.

X17405 **$499**

Game Incl.- ERADICATOR

• High performance 64-voice Wave-Table sound card • 4MB Onboard RAM for downloadable Soundfonts and E-mu Wave-Table GM Midi Bank • E-mu 3D Positional Audio positions sound in a 360° 3D environment providing an immersive audio • Creative's WaveSynth/WaveGuide for expressive & realistic instrument sounds • CD-Quality, 16-bit, stereo sound- 8 and 16-bit stereo recording and playback • Gold RCA output and S/PDIF connections

LATEST CPU PRICE intel

PENTIUM 120MHz	$199
PENTIUM 133MHz	$299
PENTIUM 150MHz	$329
PENTIUM 166MHz	$429
PENTIUM 200MHz	$499
PENTIUM 166Mhz MMX	$549
PENTIUM 200Mhz MMX	$899

LOOK! LATEST

PENTIUM PRO CPUs & MOTHERBOARDS

CPU	CPU ONLY	M.B. INCL.
150MHz	NA	$999
180MHz	$795	$1095
200MHz	$995	$1295

AVAILABLE ON ORDER AT OUR STORES OR BY MAIL ORDER

OKIPAGE 4W LED "LASER" PRINTER

C22374 **$489**

THE COMPACT PRINTER THAT IS BIG ON PERFORMANCE

600 dpi with MicroRes 600

• Ideal for small business or home users

HOT PRICE **$379**

IT'S A REAL CUTIE!

Toner Cartridge (last 1,000 copies)- *only* ***$29.95***

Includes ***100 FREE Internet Access*** *hours from rie.net.au- ask for details.*

jaz traveller

ALL NEW!

Your Jaz™ Portability Solution

Jaz™ Traveller is a SCSI to parallel port convertor for Jaz drives.

• Connect to your Jaz drive to the parallel port of any PC, *without opening your computer.*

• Move your stuff anywhere, at work, at home, or on the road.

• Easily take your stuff from a Mac to a PC.

• Jaz Traveller for *on the go!*

C11956 **$96.95**

COMPUTER CARDS - HUGE RANGE!!

ISA

CAT NO.	DESCRIPTIONS	PRICE
X18075	1Meg 16bit VGA	$159
X18004	IDE/SPG	$39
X18005	High Speed I/O	$59.95
X17072	ADAPTEC SCSI 16bit 1522A *(Limited Stock)*	$189
X17068	SCSI Controller Adaptor AHA-1520A	$179
X18165	16bit ETHERNET RJ45 + BNC	$49
X15810	Ethernet 5-port 10 base T hub	$149
X15814	Ethernet HUB 10 base T Connector (8 RJ45 Effective)	$179
X15816	Ethernet HUB 16 base T Connector (14 RJ45 Effective)	$349
X15818	Ethernet HUB 20 base T Connector (19 RJ45 Effective)	$369
X18228	Printer Lpt123 Card 16-Bit NEW!	$49
X18232	Printer 2-Port Slot Lpt123 Card 16-Bit NEW!	$69
X18017	Printer Slot Lpt 1 Card	$19.95
X18141	High Speed Serial Card 1-Port 16550	$49.95
X18041	High Speed Serial Card 2-Port 16550AFN	$59.95
X18143	High Speed Serial Card 4-Port 16550AFN	$189
NEW!	Dual Speed 16650 UARTS modem chip	$99
X18019	Games Card	$19
C14260	SMART GAMES Cont	$39.95
X18171	Ethernet **Intel PnP** BNC/RJ45 16-bit	$199
	*Ethernet **III Rev B Coax (BNC, AUI)**	$250
X17396	OEM SBlaster PnP Vibra 16 with IDE interface	$109
X17394	OEM SBlaster PnP Vibra 16 without IDE interface	$99
X17398	OEM SBlaster PnP Vibra 32 Sound Card	$189
X17357	OEM PhoneBlaster	$289
X17250	ESS 16 Bit Sound Card	$39

SB OEM products do not have manual or connection cables

***AVAILABLE TO ORDER**

VLB

X18003	ENHANCED VESA MULTI I/O	$49
X18050	VESA IDE ENHANCED MULTI I/O- **PROMISE TECH**	$129
X18100	VESA VGA CARD	$149

PCI

X17900	PCI 1M VGA TRIDENT 9440	$59
X18238	New PCI 1M TRIDENT 64-BIT MPEG/VIDEO	$89
X18240	New PCI 1M TRIDENT 3D TV-OUT MV685	$119
X18244	New PCI 2M TRIDENT 3D TV-OUT MV685	$139
X18206	PCI VGA DIAMOND STEALTH 1MEG DRAM	$109
X18207	PCI VGA DIAMOND STEALTH 2MEG DRAM	$139
X18208	PCI VGA DIAMOND STEALTH 2MEG VRAM	$399
X18209	PCI VGA DIAMOND STEALTH 4MEG VRAM	$599
X18222	New OEM Diamond Stealth 3D Video 2MEG Non-upg	$159
X18218	New OEM Diamond Stealth 3D Video 2MEG Upg to 4MB	$189
X18226	New OEM Diamond Stealth 3D Video 4MEG DRAM	$219
X18250	New Diamond Monster 3D 4MEG EDO DRAM	$499
X18230	New MYSTIQUE 2MEG 3D ACCELERATOR	$295
X18234	New MYSTIQUE 4MEG 3D ACCELERATOR	$395
X18183	PCI VGA CIRRUS LOGIC 5430 1MEG	$59
X18195	PCI VGA 64-BIT CIRRUS LOGIC 5436	$199
X18210	2MB WRAM GrafixStar 700 Video	$499
X17073	PCI SCSI MASTER ADAPTEC 2940	$379
X17077	New **PCI ULTRA WIDE SCSI ADAPTEC 2943**	$569
X18212	PCI MGA MILLENNIUM 2MB WRAM	$429
X18214	PCI MGA MILLENNIUM 4MB WRAM	$595
X18216	PCI MGA MILLENNIUM 8MB WRAM	$895
X18510	PCI Ethernet BNC/RJ45	$65

***AVAILABLE TO ORDER**

EPSON STYLUS™ COLOR 200

PHOTO QUALITY COLOUR

$399 C92300

HOT PRICE- **$279**

• High resolution 720 x 360 dpi

• Photo-quality output

• Improved output on plain paper stock

• Interchangeable colour and monochrome print heads • 400 A4 sheet feeder

DIGITAL MULTIMETER

Q13077

1000 SOLD!

1-9 **$17.95**

10+ **$15.95**

The ideal meter for technicians with a full 3½ digit LCD readout. Requires a 9V battery either alkaline or carbon. Expected life of carbon battery is 100 hours and 200 for the alkaline.

SPECIFICATIONS:

DC Voltage:	200mV/2/20/200/1000V
Basic accuracy:	+/-0.5%
Input Impedance:	1M
Maximum Input:	1000V DC
AC Voltage:	200/750V
DC current:	200A/2000A/20mA/200mA/10A
Resistance:	200W/2000W/20kW/200kW/2M
LCD Display:	15 x 46mm
Dimension:	70 x 126 x 24mm

SCOOP PURCHASE!

12" POLYPROPYLENE WOOFER

~~$69.95~~

HOT PRICE **$59.95**

C12044

• With black frame

• Dark grey cone and silver dust cap

• Rubber mounting seal Foam edge

120 WATT *50¢ a watt!*

ERRORS & OMISSION EXCEPTED. PRICE CHANGE WITHOUT NOTICE.

THE SERVICEMAN

The computer that was being eaten by a strange sticky liquid...

Among our servicing stories this month is one from a fellow serviceman in northern NSW, who tends to specialise in computers — but the fault in question was decidely 'low tech' in origin! We also have some interesting tales about fixing a Tandy VCR that was 'too hard' for a commercial repair shop, and resurrecting an old Goldstar CTV that somebody had dumped — after twiddling every last preset adjustment.

This month we have a number of shortish items for you, the first of which is an amusing account of the results of an encounter with some wild life. This story comes from Jim McCloy, of Muswellbrook in NSW. Although the job turned out all right in the end, I'm sure Jim would rather it had gone to someone else. Here's what he has to say...

The Serviceman's story in December EA about a contaminated Samsung TV was interesting. I wonder where the corrosive material came from and what it may have been. Like the Serviceman, I have had similar situations where it has been the very devil of a job to pry the full facts out of the customer.

The following story tells a similar tale, although in this case I was finally left in no doubt as to what the contaminant was, and where it had come from.

In the days when the local Skillshare people were teaching computer skills, the first machines used here were Amstrad 1640 twin-floppy machines. A couple of years later they were updated by fitting 20MB hard drives and the great drama was the need to use tinsnips to 'modify' the shielded drive mounting cases.

About 18 months later still, I received a call to service one of these machines, which was playing up in a way that somewhat defied description. The error messages were bizarre at the very least. On testing the computer, I found it was obvious that the hard drive and its controller were playing funny games; so the decision was made to take it to the workshop for a proper examination.

This particular Amstrad model had the power supply in the monitor, which in turn has its base fitted into a socket in the plastic top of the computer case. Also under the monitor, in the computer case, is a pocket to carry AA batteries to provide backup power for the CMOS memory.

My attention was drawn to this battery pocket by a brownish sticky liquid over the batteries, and I casually reminded the Skillshare staff that they needed to have new batteries fitted and that those present appeared in a flat and leaky state.

In the workshop however, when the case was removed, it was found that a considerable amount of the fluid was present, too much to have come from two AA cells. I took a tiny taste of the substance from the tip of a finger and found it to be of an acid character and not at all like battery juice.

Further examination revealed the liquid had run down over the hard drive and onto the electronics board. Removal of the hard drive and stripping of the PCB from the drive showed the fluid actively gobbling up the copper tracks.

The fluid was immediately neutralised with an ammonia solution, washed off with distilled water followed by alcohol to remove the water, and then electronic component cleaner to remove all traces of the previous solutions!

Examination of the tracks on the PCB showed considerable damage, but in no case did any tracks appear to be totally cut. The hard drive was reassembled and temporarily connected in the computer. When it was fired up, lo and behold the drive worked perfectly. After a coat of varnish and reassembly the computer was as good as new.

I then went back to the Skillshare premises and demanded to know just who had poured some unknown fluid over the computer. Imagine my surprise when the Officer In Charge said "Didn't they tell you? We had a possum locked in the computer room over the weekend!" and he then proceeded to treat the whole affair as a huge joke!

The OIC explained that the possum had also 'treated' the computer keyboard for good measure. All they had done was to stand the keyboard on its corner to drain and then left it in the sun to dry off!

Right up to the day that the computers were offered up for sale to the public, some years later, that keyboard to my knowledge had never missed a beat. The hard drive also went on to give good service and possibly some person is still making use of it.

As one who had earlier recovered typewriters, calculators and other office equipment from the familiar dose of coffee, soft drink and the like, this event certainly topped my list.

Ugh! People!?

Jim, I agree totally with your final exclamation. People are the blight on a serviceman's life. Yet where would we be without them? Without people there would be no customers, no work and no

pay packet on Friday. I'm afraid we just have to put up with them...

As for your story, this is the first that I can remember about problems with wildlife. We have had all manner of domestic animals featured in these stories. Cats and dogs are noted for distributing liquid contaminants, and rabbits, mice and parrots use sharp teeth and beaks to destroy electronic equipment. But this is the first time that a bush creature has stood accused. I'm glad for Jim's sake it wasn't a kangaroo that broke into the computer room.

No circuit, no fix!

Now we come to a couple of stories told by Darren King, of Pakenham in Victoria:

Since I last wrote in this column, I have had quite a few televisions and videos in for service, mostly 'love jobs' for the family and mainly routine stuff like belt kits and dry joints. But there are two tales where the original problem wouldn't have been so complicated if it were not for someone twiddling with the preset adjustments. And needless to say all the twiddling had not fixed the original fault...

The first item was a Tandy VR-2000 video which was given to me by a friend who asked me to see if it could be fixed. He had already taken it to a so-called 'expert' repair centre and they said that as a circuit diagram for it wasn't available, they would not take on the job. So I was the last resort before it was condemned to the bin (or at least my parts bin, if I couldn't fix it).

When I set up the unit to see what the problem was, I found that on playing a known good tape, the unit would only produce a black and white picture. And on record the unit wouldn't put any signal on the tape at all. Through all this, sound and system operation was quite normal.

The first thing I had to to do was to find a suitable circuit diagram. Diagrams for such complicated products as VCRs must exist somewhere, and while tracking one down might be too time consuming for a professional serviceman, as an amateur this constraint was no problem to me at all. In fact, it turned out to be easier than I ever expected.

I phoned my friendly manual source and was immediately put on the right track. He said that Tandy videos were mainly of Teac origin, and said that he had a circuit for a particular Teac which also covered a Tandy VR-1900. He suggested this should be pretty close to the one I wanted; but when I received the circuit, it turned out to be an exact match. The circuit he sent was for Teac models MV445 and MV450, which also covered the Tandy VR-1900 and VR-2000.

Back at the bench, I reasoned that the best place to start was to see if I had proper voltages from the power supply. After testing all the rails from the power supply at the connector on the board, it was confirmed that all was quite normal. The next step was to take a look around the playback section with a CRO. This chassis uses a main PCB with smaller upright modules, which contain mainly surface mounted parts.

All connections to and from these modules are by pins soldered to the main PCB and are labelled on the circuit diagram by a dashed border and pin numbers, rather like an IC. Testing around the playback module produced a mixed result and I was sure that what I was getting out of the module was not what I expected. Input to the module from the head amplifier was normal.

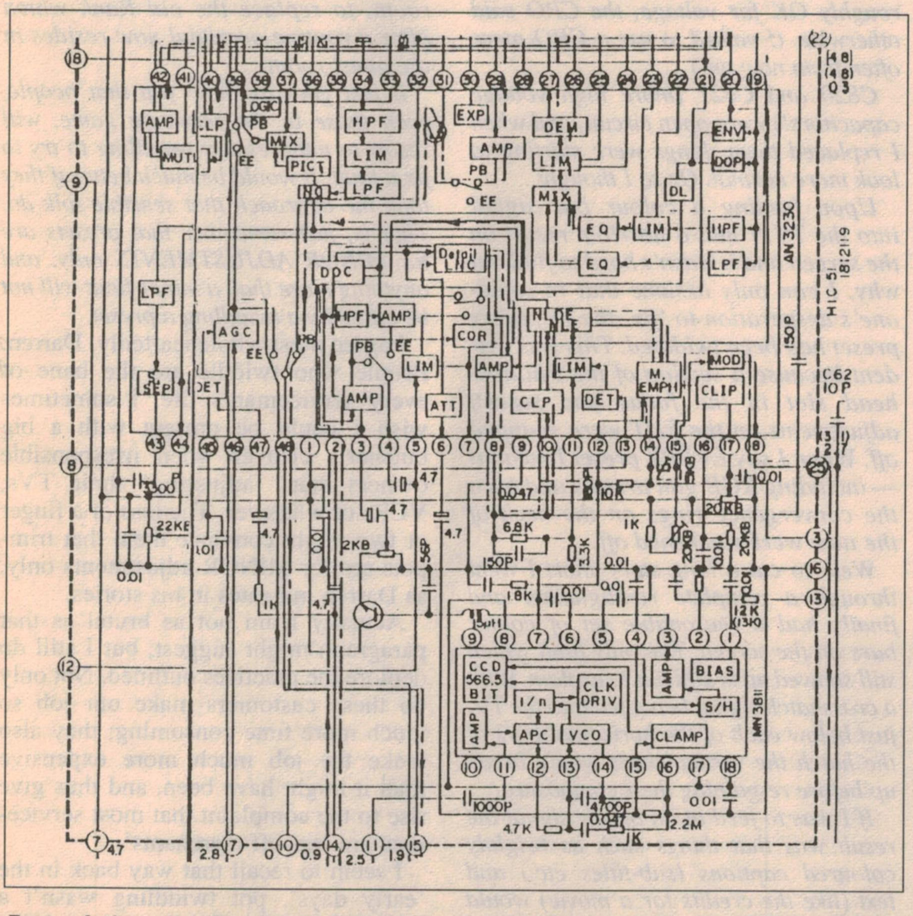
Then I noticed I had overlooked a couple of 5V regulators on the main PCB, marked IC51 and IC52. As luck would have it IC52 was faulty, and at best all it could manage was a little over three volts on the output. A new garden variety three-terminal regulator restored the 5V rail, and more importantly, a nice sharp colour playback.

Feeling rather more confident, I recorded a test signal and expected to see a nice playback of a test pattern. But no such luck! The unit still recorded nothing but noise.

I turned my attention to the recording side of things, and worked back from the head amplifier. The first point of call was the test point on the head amp PCB, TP1, where I expected to see the familiar 'cotton reel' pattern. But there was nothing. I then tracked back to the main PCB and the base of Q55, where I should have seen modulated luminance. Again nothing.

Next, it was to pin 18 of the AN3230 IC on the luminance module, IC51. Again I drew a blank. Testing at TP3 on this module produced a good resemblance of the waveform shown on the diagram. There is not much between TP3 and the modulated output (pins 14 and 18 on the IC respectively) and I started to cast suspicion on the chip. Then I noticed something peculiar about the module. It looked as though it was missing a trimpot!

On closer investigation it turned out that the trimpot WAS missing — snapped



Part of the circuitry for the luminance module of a Tandy VR-2000 video recorder, which forms the subject of Darren King's first story.

clean off the PCB and not even rattling around inside the case! Needless to say that was the problem; the 5kΩ trimpot between pins 14 and 15 of the IC was missing and was nowhere to be seen.

The problem now to be faced was that the trimpot was one of those surface-mounted types, and a direct replacement was not readily available. Similarly, the cost of a replacement 'HIC 5L' module was not worth it either.

Then I had an idea. There was plenty of copper pad left on the PCB where the trimpot used to be, and a search through the junk pile soon turned up a suitable 5k trimpot that could be made to fit.

This took a bit of careful pin-bending, but the end result was that I now had a modulated signal being put on the tape. With a bit of realigning (yes, all the other trimpots had been twiddled!), there was now a first class picture being recorded on the tape.

The unit was duly returned to my friend, who vowed "...never to take anything to those butchers again!" I know that he is not technically minded, and there is no way he would have been fiddling with the unit himself...

Twiddler's discard

Darren King continues:

The second of my two stories concerns a discarded Goldstar 19" colour television model CBY-9321, fitted with a PCOBXB chassis.

I was doing the rounds at the local council 'hard rubbish' collection, or as I like to call it 'kerbside shopping', where I source quite a lot of hard to get (and often expensive) spare parts. It amazes me that people will throw out stuff which has 99% of its parts still useable.

Anyway, I came across this Goldstar television and apart from the fact that the back was being held on by only one screw instead of six, it looked to be intact.

Back at home I gave it a quick once over to see if all the plugs/sockets were where they should be, and then switched on. Sound came up normally, but I had a very dark picture on the screen. The EHT whistle seemed normal, so I pulled out the circuit diagram and started looking at the main voltage rails.

This is quite an interesting chassis, since at first glance it looks as though it should be a 'live chassis' design. But it also has a SCART connector for video and audio in/out, suggesting that it is not live at all.

The design is such that the input to the power supply is 'live', but the output of the switchmode transformer is tied to the chassis and isolated from the mains. This is the same type of design as used in computer power supplies. A quick check with a multimeter showed that I had a reasonable output across C818 and although no voltage markings are evident for this rail, it looked reasonable considering the 25V rating on the capacitor.

Across C820 I had about 120V, which was only slightly higher than the marked 112V at TP15; so I reasoned that this was OK too. The next check was the 180V line on pin 1 of P451 going to the neck board. This voltage was way down, so I suspected the capacitor C422 — seeing that it was one of those unreliable high voltage/low capacitance types. This was replaced, but the result was no different. I was starting to cast suspicion on the EHT transformer, when I decided to switch from multimeter to CRO.

For some reason I started from the 112V rail at TP15, and this is where I struck gold. There was nothing like a reasonably flat 112V rail here. It was more like a very jagged sawtooth. Even though the multimeter told me that this rail was roughly OK for voltage, the CRO said otherwise. (I vowed to use a CRO more often from now on!)

C820 and C821 (more high voltage capacitors!) were open circuit, and when I replaced them things were starting to look more normal. Or so I thought...

Upon feeding a colour bar signal into the TV, I had a horrible result on the screen and it wasn't hard to find out why. I can only assume that in someone's desperation to 'fix' the TV, every preset had been twiddled. This was evident because a section of the Phillips-head slot in the focus and screen adjustments on the EHT were snapped off. When I say EVERY preset I mean it — including RGB gun presets and even the convergence rings on the neck of the tube were slackened off.

Well, to cut a long story short I went through a complete re-alignment and finally had a reasonable set of colour bars on the screen. The only fault which still showed up is difficult to explain. With a crosshatch signal being fed into the TV, just below each of the horizontal bars of the hatch the vertical bars would break up before re-gaining their composure.

If I was to feed in an off-air signal the result was that things such as brightly coloured captions (sub-titles etc.) and text (like the credits for a movie) would take on a sloping, italics appearance and the rest of the screen would have streaky horizontal lines in it. All in all, a pretty distressing display.

When I first switched the set on, the picture would appear with a normal crosshatch but then gradually start to break up after about five seconds. Also, winding down the 'screen' control on the EHT transformer would correct the problem — but of course, left a very dark picture. None of these symptoms seemed to make sense to me, so I checked vertical deflection, horizontal deflection and every point in between. I even re-checked the power supply, but found nothing.

I was just about to give up when I noticed something I had overlooked. The grounding strap on the back of the picture tube was in place, but the wire going from the strap to the ground point on the neck board wasn't! It was not even in the cabinet or wiring loom. I made up a new lead, fitted it and switched on.

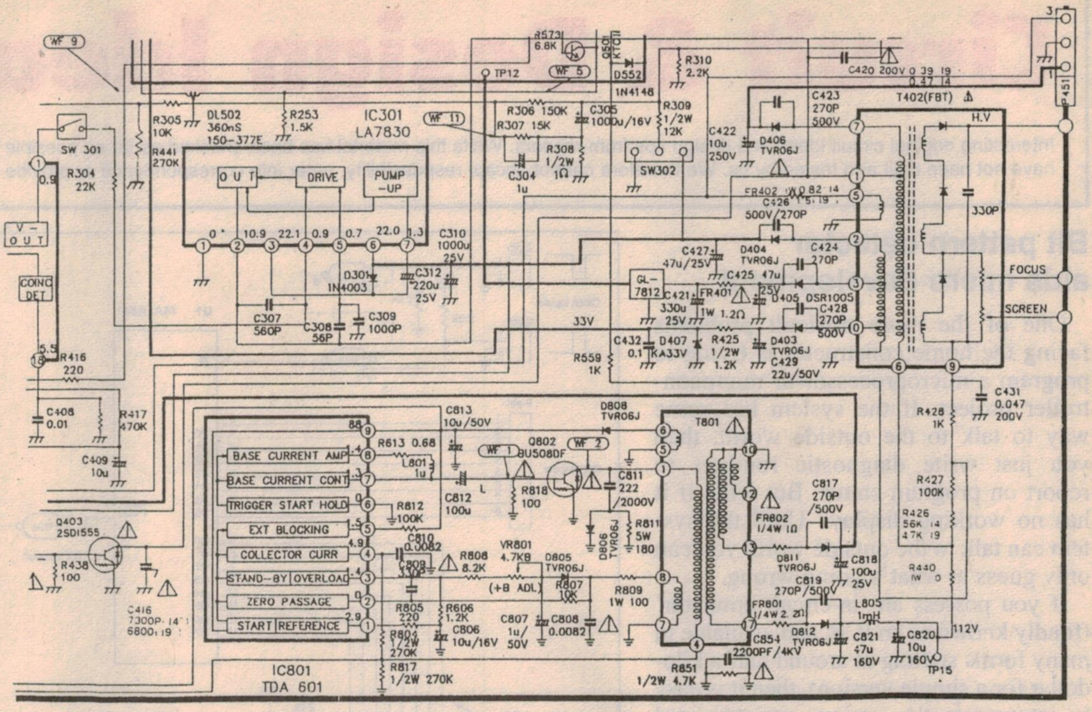
Up came a perfect picture, with no signs of the wriggling or streaking that had plagued the screen a few minutes earlier. And now I have a relatively new 'monitor style' TV for my living room, to replace the old Rank which after a routine overhaul now resides in the guest room.

It just goes to show you that people, even those in the servicing game, will resort to unnecessary twiddling to try to fix a fault. It would be much better if they took the approach that sensible folk do. That is, just remember that presets are for MINOR ADJUSTMENTS only, and anything more than a minor fault will not be cured by a twiddling a preset.

I agree most wholeheartedly, Darren. People who twiddle are the bane of every serviceman's life. I sometimes wish I could be present with a big butcher's cleaver when irresponsible owners start 'adjusting' their TVs, VCRs or whatever. The loss of a finger or two might convince them that trimpots are for MINOR adjustments only, as Darren indicates in his stories.

Actually I am not as brutal as that paragraph might suggest, but I still do deplore the practices outlined. Not only do these customers make our job so much more time consuming; they also make the job much more expensive than it might have been, and thus give rise to the complaint that most servicemen are 'rip-off merchants'.

I seem to recall that way back in the 'early days', pot twiddling wasn't a serious problem. One reason was that TV sets were relatively expensive and



The switchmode power supply and horizontal output circuitry of a Goldstar CBY-9321 colour TV, using a PC-08XB chassis. When Darren King tried to fix it, every preset had been tweaked...

owners didn't want to mess them up. But the main reason was that manufacturers would seal the trimpots after adjustment, using various sealing compounds that locked the pots into an immovable setting.

There were times when I cursed the practice, since it made any necessary adjustments much harder than they otherwise might have been. But it *did* make it less likely that fiddlers would get away with their malevolent activities...

Thanks for those stories, Darren. They were quite interesting and we'll look forward to more in the same vein.

Check 'em first!

Now for a short story from contributor Peter Godfrey, of Nymboida in New South Wales. Peter's story is one about a very common fault, but with a set of symptoms as misleading as any I have ever heard of. Here is what he has to say:

I have been involved for about four years as a mostly part time electronics technician. I prefer to stick to audio gear and power inverters, feeling that to specialise a little gives me a better chance of earning a living in this difficult and changing trade.

Recently I found a Sansui DA-T1750 Tuner Tape deck on my bench. Normally I hate these things, as the manufacturers just stuff them untidily into a box, with never a thought for the poor fellow who may have to sort out the tangle in order to fix them.

This one was no exception, with small soldered-in boards at right angles to the main preamp board and other control boards just hanging off the pots. There are also heaps of interconnecting cables and plugs, just to make things even more difficult.

The fault sheet said that it lost volume occasionally, and I groaned "Oh no, not another intermittent!"

I plugged it in, connected some speakers and switched on. Fortunately, the intermittent had become permanent and there was no sign of the 'technician syndrome'.

The sound was clear enough, although low in volume, with no signs of any distortion or hum etc. I tried it on radio, tape and external input and all showed the same symptoms — very low volume but clear sound.

I felt the volume was about one third the level I would have expected so, as the CRO was switched on, I had a look for signal at the volume pot. I usually make my first step to isolate the fault into either the power amplifier or the preamp.

The signal was a little low at the volume pot, so I checked the level in and out of the main chips in the preamplifier and found it was definitely amplifying.

I had suspected a dead chip, with only leakage getting through. However, with a little intuition and a memory of an earlier Serviceman article, I checked the voltages on the chip. To my surprise there was no -20V rail. The positive rail was there, but no negative.

It was a fairly easy fix from there on. I traced the fault to a shorted electrolytic in the power supply. The cap must have only been leaking enough to pull the rail down, because the series dropping resistor was still intact, with no sign of overheating.

Assuming that the owner's description of the fault was correct, I can't imagine how it lost volume intermittently. Neither can I explain how it managed to work without distorting, with one rail completely missing. As it is, I was simply happy to fix the thing and be paid for the job.

The first part of any repair job requires the serviceman to look at the symptoms, then deduce from his observations a likely cause of those symptoms. But what do you do if the symptoms point in the opposite direction?

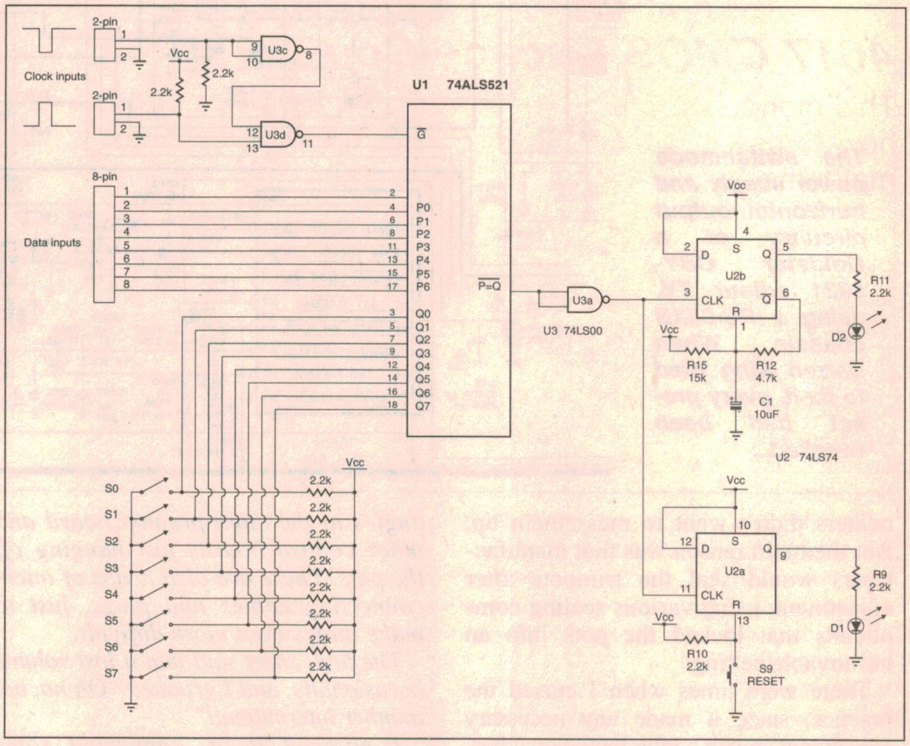
But as I have pointed out on numerous occasions, the First Commandment of servicing is 'Thou shalt first check voltages' — and although our contributor eventually got around to obeying this order, he still lost time considering other more likely scenarios.

Finally, the 'intermittent' symptom was not all that unusual. Electros can go intermittent, either short or open circuit. They can just fail slowly as the electrolyte dries up, or they can go leaky, a little or a lot as the mood takes them. Electros are the most unreliable component in any electronic device, and the man or company that comes up with an effective substitute will be on a real winner.

Thanks for that story, Peter. It's an interesting one to finish up with this month. ❖

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Bit pattern detector aids micro development



One of the more difficult problems facing the home constructor is trying to program a microprocessor or microcontroller project. If the system has some way to talk to the outside world, then you just write diagnostic routines to report on program status. But what if it has no working display? Until the system can talk to the outside world you can only guess at what's going wrong.

If you possess an 'in-circuit emulator' (fondly known as an ICE, and available in many forms starting at around half a kilodollar for a simple version), then it is easy to interrogate the various registers and ports and track the programs progress. Otherwise you need this little beauty.

Basically the device is an 8-bit wide comparator U2 which compares the status of eight flying leads against the settings of the matching eight switches, and indicates if they are the same. There are an extra two inputs which are normally used as trigger inputs so the comparison occurs only when a clock is high or low according to which of the two trigger inputs are used. If the clocks are not required then they may be either ignored and left open, or perhaps even used to give a 10 bit wide sample. The outputs are a latched LED to capture an event that you didn't see because you were looking elsewhere, and a pulsed LED to indicate recurring events.

In use, you insert 'write to port' commands at strategic locations in the program, to write an identifiable pattern to the port to which you connect the comparator. You can use any available port, and I usually just send an incrementing binary sequence to indicate that the program has reached point 1, 2, 3 etc. This allows you to watch for each event in turn, to map the program's progress.

Of course to capture each subsequent event means resetting the switch pattern, resetting the latched LED and restarting the micro. Even if you have no ports to spare in the final setup it is usually possible to requisition one temporarily to get the majority of a project running, then surrender it back when you are far enough progressed to have other means of communication with the project. Alternatively use the trigger inputs to decode an address location and hang the comparator off the bus.

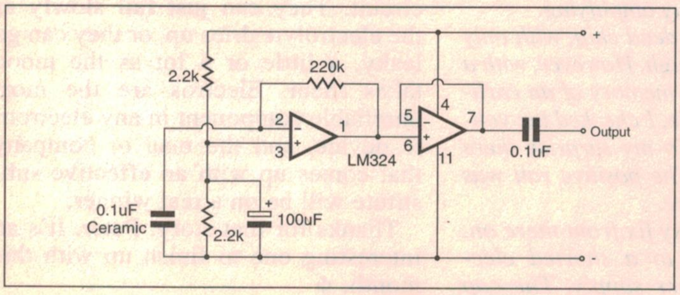
I managed to squeeze the eight toggle switches and reset button into the smallest plastic jiffy box, and used flying leads with microhooks to power the unit from the subject project's power supply.

B.J. Robertson
Wangaratta, Vic. **$40**

THIS MONTH'S WINNER!

Rugged 'knock' sensor

While piezo elements are quite sensitive to knocks and bumps, they're likely to crack under stress — resulting in a severely reduced output voltage.



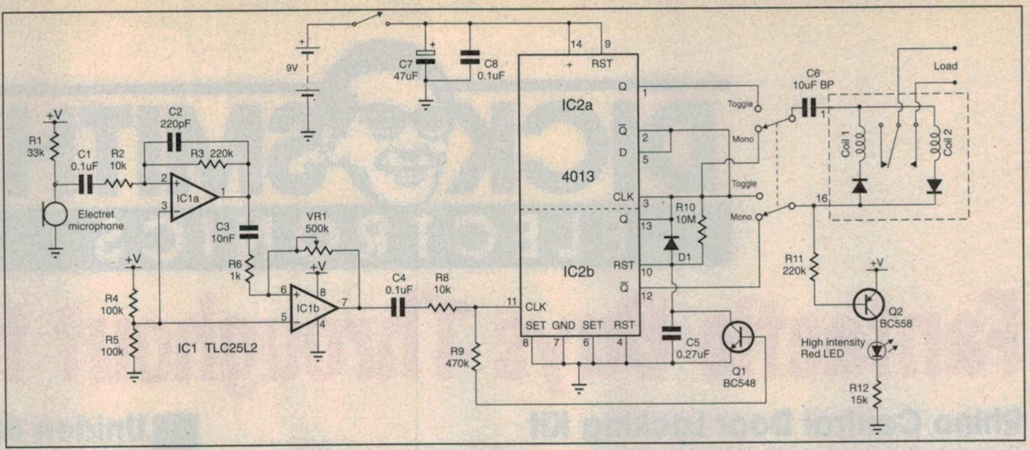
It's perhaps not surprising to know that disc ceramic capacitors exhibit a piezo electric effect, considering that they share the same basic construction with piezo elements — a piece of ceramic material sandwiched between a pair of conductive plates.

Using the circuit shown here, knocks, bumps and other mechanical events can be detected with nothing more than a 0.1uF disc ceramic capacitor. It is worth experimenting with different types of capacitor, as you'll find that different makes, sizes and voltage ratings will all have an effect (even tiny monolithic bypass capacitors work as well).

If you are mounting the capacitor in an electrically noisy environment, be sure to use shielded cable for the connecting lead into the circuit.

Graham Cattley, EA Staff

Micro-power sound switch



By using a latching relay which only draws current while switching, this sound activated switch will run for months on a single battery.

The circuit consists of two amplifier stages (IC1), a monostable (IC2b) and a D-flipflop in toggle mode (IC2a). CMOS ICs, large value resistors and a sensitive electret mic insert (from Altronics) result in a low stand-by current of only 280uA (though R1 might need to be reduced for a less sensitive microphone).

IC1a and b are wired as inverting amps and are DC biased to half the supply voltage by R4/R5. The signal from the microphone is fed into the inverting input of IC1a, which is set to a gain of 22 (12dB). This feeds to IC1b, and the feedback of this second stage can be varied via VR1 — giving an overall gain of 32-40dB.

The relay is a latching type, with two coils and internal diodes. When the relay is energised by having pin 1 high and pin 16 low, coil 2 pulls the contacts into the on position; but if the polarity is reversed, coil 1 pulls the contacts back into their initial position (off). The internal diodes prevent both coils being energised simultaneously.

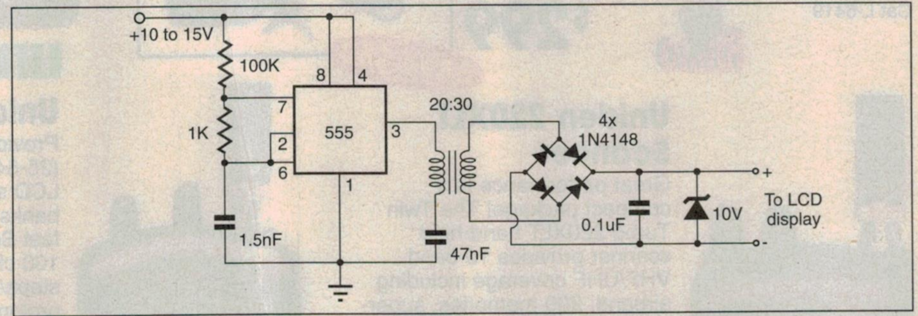
IC2b is wired as a monostable, and when triggered at its clock input (pin 11) its Q output goes high and Q-bar low. This pulses coil 2 via C6, and the relay is switched 'on'. Capacitor C5 at the reset pin now charges via the 10M resistor, and after a two-second delay the trigger level of the reset pin is reached. Both outputs now reverse state (Q goes low and Q-bar high), the relay is pulsed via coil 1, and C5 is discharged via D1 into the Q output. If noise is still present while the monostable times out, Q1 is repeatedly biased on and keeps C5 discharged by shunting it to ground. In this way the monostable can't reset and so the relay remains on even when the sound level falls.

Every time the mono is triggered, its Q-output goes high and toggles IC2a on and off. Since the D input is connected to its Q-bar output, data is low when the Q output is high and the next trigger transfers the low to it — thus the complementary outputs toggle on and off.

The DPDT switch selects either momentary or toggle mode. The momentary mode is perfect as a hands-free microphone switch, the toggle mode for lights etc. (In this mode the sensitivity should be set low to allow the mono to time out). Q2 switches on when the Q-bar output is low, showing that the relay is on by lighting a hi-intensity LED. When powered by a fresh 9V alkaline battery the circuit keeps running up to one full month continuously, and five months continuously on six AA-type batteries!

Manfred Schmidt
Edgewater, WA **$30**

Supply makes LCD meter self-powered



I recently needed to run an LCD panel meter directly from a 12 volt battery power system, and use the meter to measure the battery voltage and current. However, the panel meter required a power supply of 12-15 volts, isolated from the voltage source to be measured, so could not be run from the battery directly.

This circuit was the solution. The CMOS 555 timer oscillates at a frequency set by the 100k and 1k resistors, and the 1.5nF capacitor. This drives a small ferrite core transformer with 20 turns on the primary, and 30 on the secondary. The 47nF capacitor blocks the DC component of the 555's output, preventing the transformer core from saturating.

The output of the transformer is fed into a bridge consisting of four 1N4148 diodes, and is filtered by the 0.1uF capacitor. The Zener diode regulates the final output to around 10 volts, which is used to run the LCD panel meter.

The transformer I used was a small pot-core style unit about 10mm across, and most small ferrites would work with a bit of adjusting of the circuit. Total current consumption of the circuit with the LCD connected is between 2 - 3 milliamps.

You could also adjust the turns ratio to produce higher voltages if desired.

Lance Turner
Glen Iris, Vic. **$30**

WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a compact CCD video camera module from sponsor **Allthings Sales & Services**, offering 460 TV lines of horizontal resolution and 0.05 lux sensitivity, and valued at $199.00!

DICK SMITH ELECTRONICS

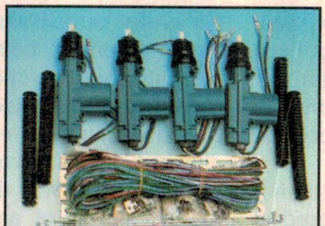
Fantastic Buys Throughout the Store

Rhino Central Door Locking Kit

Complete 4-door central locking kit, with hardware and electronic interface allowing conversion of standard door locks. Allows you to lock and unlock all doors from the driver's door, and can be connected to Rhino series 2 and 3 car alarms, and series 5 engine immobiliser, to allow keyless entry to your vehicle.

Cat L-5421

$69



Rhino

Rhino Car Alarm

A state-of-the-art alarm, featuring micro-processor controlled rolling code technology (anti-scanning, anti-grabbing), 2 remote controls, quiet arming, pre-warn shock sensor, red flashing LED, personal panic button, visual arming/disarming, engine immobilisation, auto siren reset period, all points of entry protection, door-ajar warning, alarm trigger reporting mode, service and override keyswitch, safety circuit, current sensing circuit. central locking interface, ultrasonic isolation, electric boot release, battery back-up system and auto battery testing.

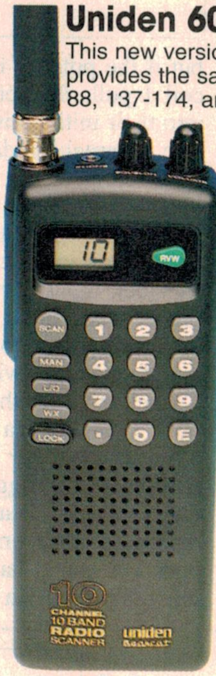
Cat L-5419

$299

SAVE $50

Rhino

Uniden 60XLT Scanner



This new version Uniden 60XLT scanner provides the same frequency coverage (66-88, 137-174, and 406-512MHz), and 10 memory channels as the old D-2746 version. It has been upgraded to include 12.5kHz frequency steps on the 137-174MHz VHF "Hi-band" allocation to match the requirements on users such as the SES/CFA, ethnic language services, and various commercial users. The new version 60XLT retains the same case size and styling, and still operates from 4 x "AA" Alkaline batteries. It is supplied with a semi-flexible antenna and comprehensive instructions. The 60XLT is covered by a 1 year Uniden warranty.

Cat D-2748

$169

uniden

Uniden 220XLT Scanner

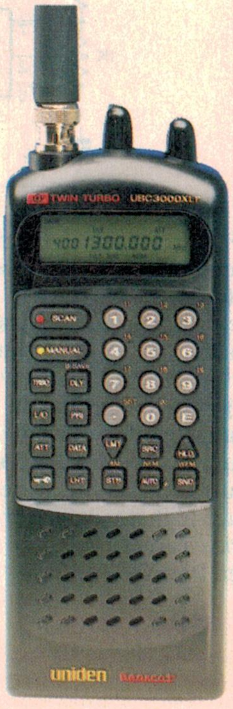
Great performance in a compact package! The Twin Turbo 220XLT hand-held scanner provides 10-band VHF/UHF coverage including airband, 200 memories, super-fast Scan and Search features (scan up to 100 channels/sec, search at 100 or 300 steps/sec), and pre-programmed channel steps to suit most Australian conditions, including 800MHz. Also Data Skip and Lock Out for faster scanning, direct keypad channel access, NiCad battery pack and AC charger, detailed instructions, and a 2-year warranty.

Cat D-2755

$369

uniden

Uniden 3000XLT Scanner



Provides wide 16-band frequency coverage (25-549.95MHz, 760-1300MHz), large back-lit LCD screen, 400 memories divided into 20 banks for easier scanning, together with super-fast Scan and Search functions (scan up to 100 channels/sec, search at 100 or 300 steps/sec). An auto battery save circuit prolongs battery life while on standby, while Data Skip and Lock Out functions allow for faster scanning. Other features include Auto Sort for faster bank scanning, 10 priority channels, selectable Search step sizes (5, 12.5, 25, 50kHz; and 30kHz on 800MHz), Scan/Search delays, battery-free memory back-up, and attenuator to reduce overload from very strong signals. Complete with NiCad battery pack, AC charger, flexible antenna, carry case, and detailed instructions.

Sensitivity: (nom. 12dB SINAD)	N.FM 0.3-0.5uV W.FM 1.2-2.5uV AM 0.4uV
Size:	69 x 39 x 187mm (W x D x H)

Cat D-2730

$469

uniden

Construction project:

PHONE CONTROLLED REMOTE POWER SWITCH

When connected to a modem, this low-cost project will activate its 240V AC outlet when a predetermined number of rings occur on the phone line. Dubbed the *Remote Power-up*, it's ideal for communication sessions between PCs where the remote 'host' machine is normally off — a far more secure way to leave an unattended PC and its valuable data. The unit has an automatic or manual shut-off feature, is easy to build using common off-the-shelf parts, and can also be used for a range of other remote power control tasks.

by ROB EVANS

If you work with a PC at home as well as the office, chances are that at some time or other you have left a crucial file behind, even though you carefully copied all of the relevant files onto a floppy disk and took it with you. As the significance of this aberration can range from minor annoyance to 'mission-critical', it would be very handy if you could simply call up the remote PC and retrieve the file over the telephone lines, using a modem at either end.

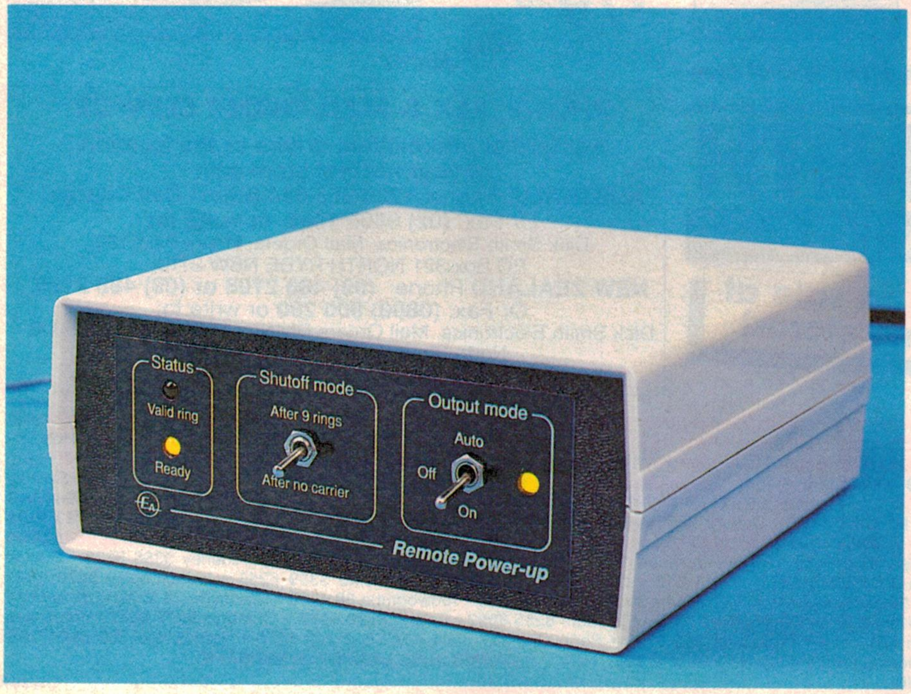
This is of course the idea behind a wide range of communications software that has *remote-access* capabilities, where the system will automatically answer a call and after a password screening process, give the caller access to that machine. The software itself can range from simple 'host' programs that present a menu offering upload, download and file viewing facilities, to fully-blown remote control software that allows you to run and control programs from the remote location.

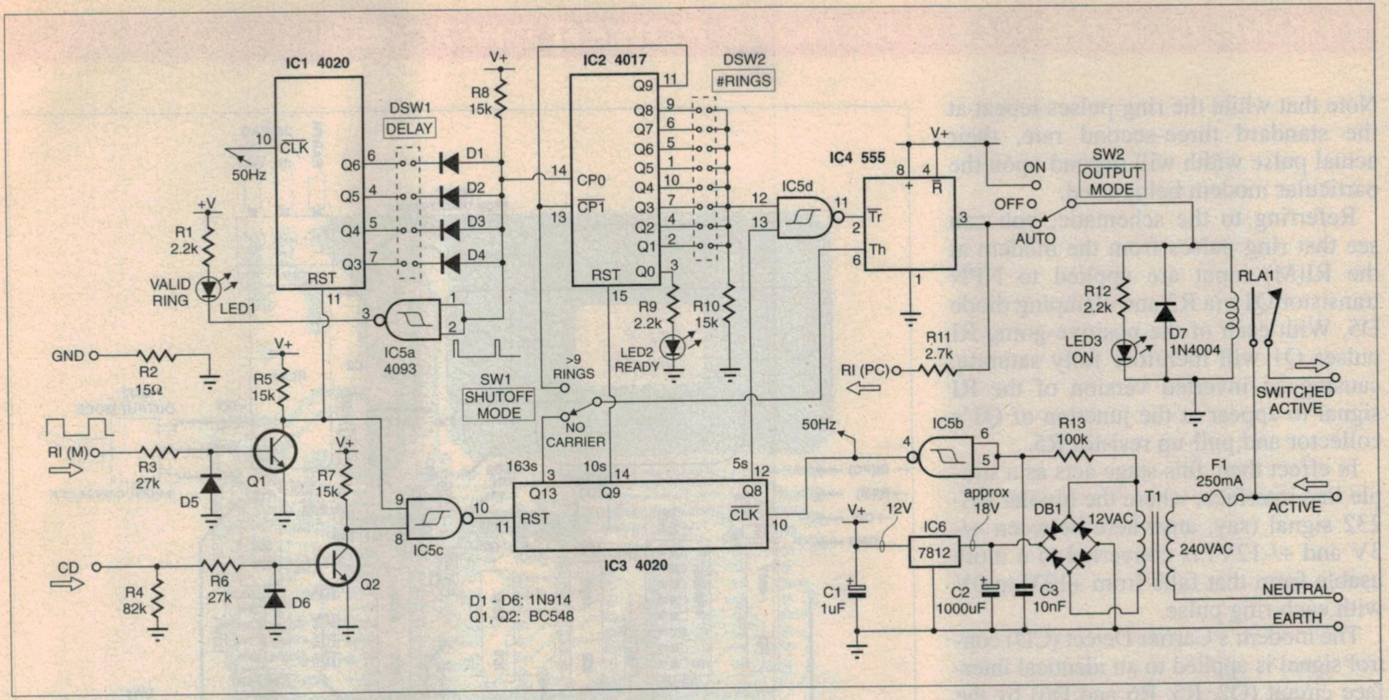
In the above scenario where you just want to retrieve a file though, all you really need is the more basic arrangement that acts as a mini bulletin board system (BBS). If this software is running at the remote location, it's a quick and simple job to call up and download the relevant file.

The problem here however, is that the home office will invariably be unattended when you need a file from there, and there's probably no one at home who can fire up the relevant comms software and send you the file. So in practice, this type of remote link is only really possible if the remote machine is left *on* all the time, with the system ready to receive a call. Unfortunately, this has several distinct disadvantages:

- Wear and Tear: Key parts of the computer such as the hard disk and cooling fan bearings will have their working life span reduced.
- Power consumption: All but the latest machines with sophisticated energy management features use significant power over an extended period. Due to this, there is an associated cost and arguable fire risk.
- Annoyance factor: Anyone who calls your number will be greeted by beeps and squeals from the modem — and to rub salt in the wound, they will be charged for the call...
- Communications reliability: If the computer software crashes during a modem comms session, the machine will stay in this state until you can locally re-boot the machine. In the meantime, remote access is not possible.
- Security: The only barrier between the PC's data and an unauthorised user is the host software's password system. This problem is compounded by the fact that every caller is aware that a modem will answer the call.

In spite of the convenience of remote access software then, the idea is rather flawed by the fact that it only really works when the remote computer system is left in less-than-ideal circumstances.





The Power-up's schematic diagram: Ring pulses from the modem at RI (M) are delayed by IC1 and counted by IC2, where the correct number will activate RLA1 via latch IC4. Counter IC3 controls the overall timing, while the CD input holds the unit on while a comms session is in progress.

Remote Power-up

As you've no doubt gathered, our new Remote Power-up unit solves these problems rather neatly by applying power to the host PC *only* when it's needed — for a remote communications session. If you call the system and allow a predefined number of rings to occur before hanging up, the Power-up will switch on the PC so that the remote access software can establish a connection in the normal way.

The unit will then remain in this state until there has not been a valid modem-to-modem communications link for at least two minutes — that is, well after the session has finished — where the Power-up will switch off the PC, and wait for the next call.

If an incoming call does *not* last for the required number of rings the unit takes no action, as you would expect.

The Power-up senses all of the above phone line and modem activity by monitoring the ring indicator (RI) and carrier detect (CD) handshaking signals in the computer-to-modem serial link, via an in-line RS-232 connector. This in turn means that there is no direct connection between the Power-up and the phone lines; your (Austel approved) modem provides the necessary line isolation and signal processing.

In practice, there are a couple of ways that the communications session can be established after the initial setup call has activated the Power-up, and consequently the PC. One is have the comms software arranged so that the modem answers the next incoming call, which will be you from the remote location (via a modem); and the other is to have the system call you back at a predefined number — a so-called 'callback' host system.

As you can imagine the latter option is rather more secure than the first, and if the setup will only be used by you at one known number, then this is the best arrangement to adopt. Since the modem never actually answers an incoming call (it only ever dials out) and the comms software offers the usual password system, you can be quite confident that the PC's data can only be accessed by you. Thanks to the Power-up, it's a very secure system indeed...

Another benefit offered by a Power-up controlled remote system is that there is no caller annoyance factor, since the modem doesn't normally answer a call. That can only occur if you are not using a callback system, *and* someone has unwittingly called for the preset number of rings, *and* the next call arrives before the Power-up has shut down due to the absence of a modem-to-modem communications link. All in all this is a fairly unlikely scenario, and even less probable if the unit is preset to respond to a low number of rings, such as three — most of us will allow an unanswered call to ring for some time.

The ability to re-establish communications in the event of a software crash is also assured with the Power-up system (see 'Communications reliability', above). This is because if the host software stops responding, the comms link will also be broken — say by you hanging up at the remote end — and the Power-up will time out and shut the system down. When you then call back and reactivate the Power-up, the computer will effectively undergo a 'cold boot' thanks to the preceding power shutdown cycle.

So there you have the basic idea behind the Power-up, and how it can make remote-access communications a very practical proposition. Whether you use it for that application or just as a means to remotely activate other mains-powered devices, we feel sure that many constructors will find it a highly useful project.

Hmmm, now have I left the Power-up's schematic diagram file on my computer at home?...

Circuit description

The Power-up's circuit is based on the action of three CMOS counters (IC1 to IC3), plus a common 555 timer (IC4) — arranged here as a simple flipflop. In short, the 4020 binary counter IC1 is used to reject brief pulses on the Ring Indicator (RI) line, the 4017 decade counter IC2 counts the incoming rings, while the remaining 4020 counter IC3 controls the circuit's overall timing.

Note that while the ring pulses repeat at the standard three-second rate, their actual pulse width will depend upon the particular modem being used.

Referring to the schematic, you can see that ring pulses from the modem at the RI(M) input are applied to NPN transistor Q1 via R3 and clamping diode D5. With each of the positive-going RI pulses Q1 will therefore fully saturate, causing an inverted version of the RI signal to appear at the junction of Q1's collector and pull-up resistor R5.

In effect then, this stage acts as a simple line interface, where the bipolar RS-232 signal (say, anywhere between +/-3V and +/-12V) is converted to a more usable form that falls from +12V to 0V with each ring pulse.

The modem's Carrier Detect (CD) control signal is applied to an identical interface circuit (Q2, R5, R6 and D6) by the way, but in this case terminating resistor R4 has been included so the optional CD line can be left disconnected.

Returning to the ring pulses, you can see that the inverted RI signal at Q1 is applied directly to IC1's reset line at pin 11. The counter will therefore be normally held in a reset state (pin 11 high) until a ring pulse arrives, where the 4020 will begin counting the 50Hz clock pulses supplied to its clock input line (pin 10).

Since IC1 will continue counting while the ring pulse is present, we can then expect its Q3 output to go high after a delay of 160ms (eight counts with a 20ms clock period), Q4 to go high after 320ms, Q5 after 640ms, and so on. So by selecting different outputs from the counter with the following DIP switch DSW1, the circuit behaves as a programmable delay.

In practice this means that if the incoming ring pulse lasts say one second and we choose the counter's Q5 output, the result is a 360ms pulse (1000ms - 640ms) that occurs after a 640ms delay. The important point to note here is that if the ring pulse lasts for *less* than 640ms, the Q5 output will remain low since the counter will be reset before the corresponding count (32) is reached. The circuit therefore rejects any 'false' short ring pulses from the modem, and accepts as valid pulses that last for a predetermined period — in this example, around one second.

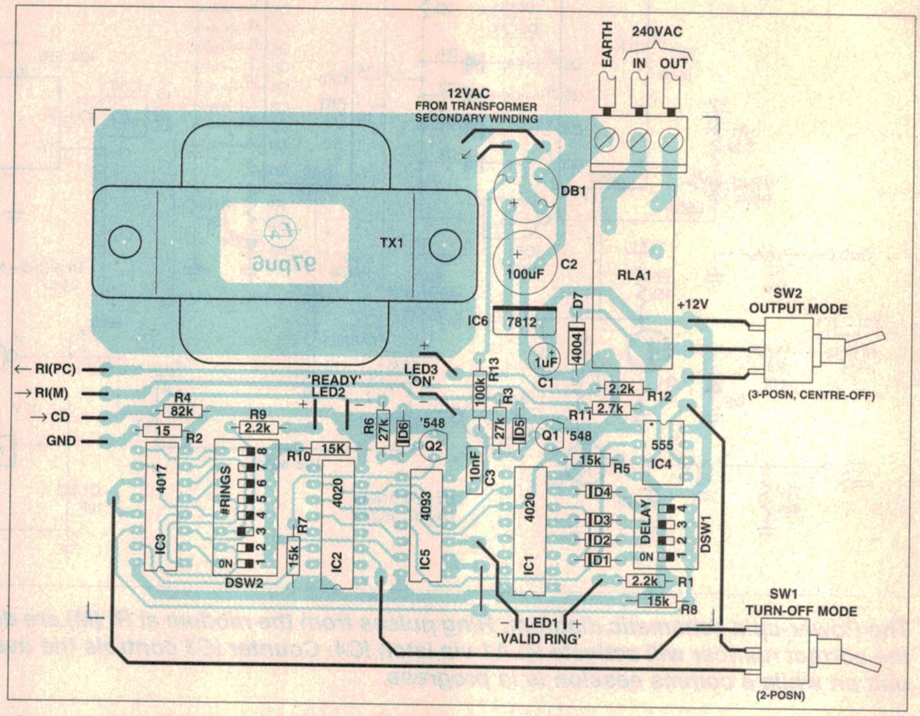
As you can see from the schematic though, the circuit is slightly more flexible than described above, since the DIP switch outputs are applied to a four-input OR gate formed by D1 to D4 and R8. This allows you to select the delay (or minimum ring pulse width, in effect) in a binary manner from zero to 2.4 seconds, in 160ms steps; selecting both Q4 and Q5 results in a 960ms delay, for example.

The output of the OR gate at pull-up resistor R8 is applied to NAND gate IC5a, which is used to drive the 'valid ring' indicator LED1 via R1. This provides visual feedback that a ring pulse of an appropriate length has been detected, and is mainly of use when checking that the delay DIP switches are correctly set for your particular modem.

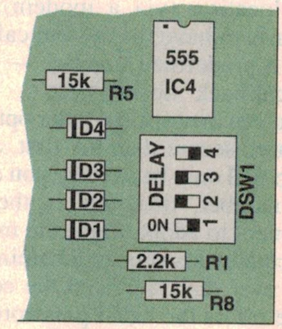
The 'processed' ring pulses at the OR gate output also feed the clock input of the following 4017 decade counter IC2 (pin 14), which as you would expect, will increment though its count with each successive ring pulse. If we are assuming that the counter has been reset before a phone call arrives then, three consecutive rings (for example) will leave IC2 with its Q3 output at a high level.

Since outputs Q1 to Q8 from IC2 are coupled to the following 'number of rings' selection DIP switches (DSW2), this can be used to preset how many ring pulses will activate the circuit. For the above example (three rings), DSW2 would be set to pass IC2's Q3 output to the following NAND gate IC5d (at pin 12).

The NAND gate's output will then



Closely follow this component overlay during construction, while noting the orientation of all electrolytic capacitors and semiconductors.



DSW1 settings

1	2	3	4	Time(secs)
OFF	OFF	OFF	ON	0.16
OFF	OFF	ON	OFF	0.32
OFF	OFF	ON	ON	0.48
OFF	ON	OFF	OFF	0.64
OFF	ON	OFF	ON	0.80
OFF	ON	ON	OFF	0.96
OFF	ON	ON	ON	1.12
ON	OFF	OFF	OFF	1.28
ON	OFF	OFF	ON	1.44
ON	OFF	ON	OFF	1.60
ON	OFF	ON	ON	1.76
N/A	N/A	N/A	N/A	N/A

Fig.3: Short ring pulses are rejected by a delay circuit, which can be preset by DIP switch DSW1 as shown here - see text. While the table lists the switch settings for a range of delay times, the default setting shown should suit most modems.

remain at its normal high level until pin 13 is raised by a timing pulse from IC3 — more about this timing circuit later. This pulse only occurs some five seconds after the ring pulses have stopped (because you've hung up to terminate the 'call'), so we can be sure that the 4017 (IC2) is not still in the process of moving to a higher count. Note that since the ring pulses arrive at three-second intervals, we need to wait for at least that time to be sure that counting has indeed stopped.

As our ring count matches the DIP switch setting (pin 12 of IC5d is high) and the five-second 'after call' delay has elapsed (pin 13 of IC5d is now high), the NAND gate's output will consequently drop low. This in turn takes following 555 timer's threshold input low (pin 2 of IC4), thereby forcing its internal flipflop into a 'set' state. The resulting high at the 555's output (pin 3) is then coupled to the output relay coil (RLA1) via SW2 (when set to AUTO), causing the relay to engage. This in turn passes the active side of the 240V supply to the Power-up's mains output socket, via the now closed contacts of RLA1.

In summary then, ring pulses from the interface circuit (Q1) are delayed by IC1 in order to reject short pulses, counted by IC2 to determine that the correct number of rings have occurred, and the result used to trigger the 555 relay latch (IC4) via the delayed gating action of IC5d.

As detailed in the following section, the circuit then remains in this state until it times-out in the absence of the Carrier Detect (CD) signal from the modem (SW1 in the 'no carrier' position), or when a second call of nine or more rings has occurred (SW1 in the '>9 rings' position).

Timing and shut-off

The circuit's overall timing sequence is controlled by the 4020 counter IC3, which is in turn clocked by a 50Hz signal derived from the mains supply. With this approach the resulting timing periods are quite predictable and drift-free, plus the circuit uses fewer components than the equivalent set of RC timing stages, and does not need to be fine-tuned by adjusting component values.

As shown in the schematic, the circuit's 50Hz clock is generated at the output of Schmitt NAND gate IC5b, and applied to the clock inputs of both IC1 and IC3. IC5b is in turn driven from power transformer T1's secondary winding via a low-pass filter based on R13 and C3, which has a corner frequency of around 160Hz so as to block the effects of any mains-borne HF interference. Note that although the transformer's 50Hz secondary waveform has a peak voltage of around 18V, IC5b's input stage will not be overdriven thanks to its built-in protection diodes and the current limiting effect of R13.

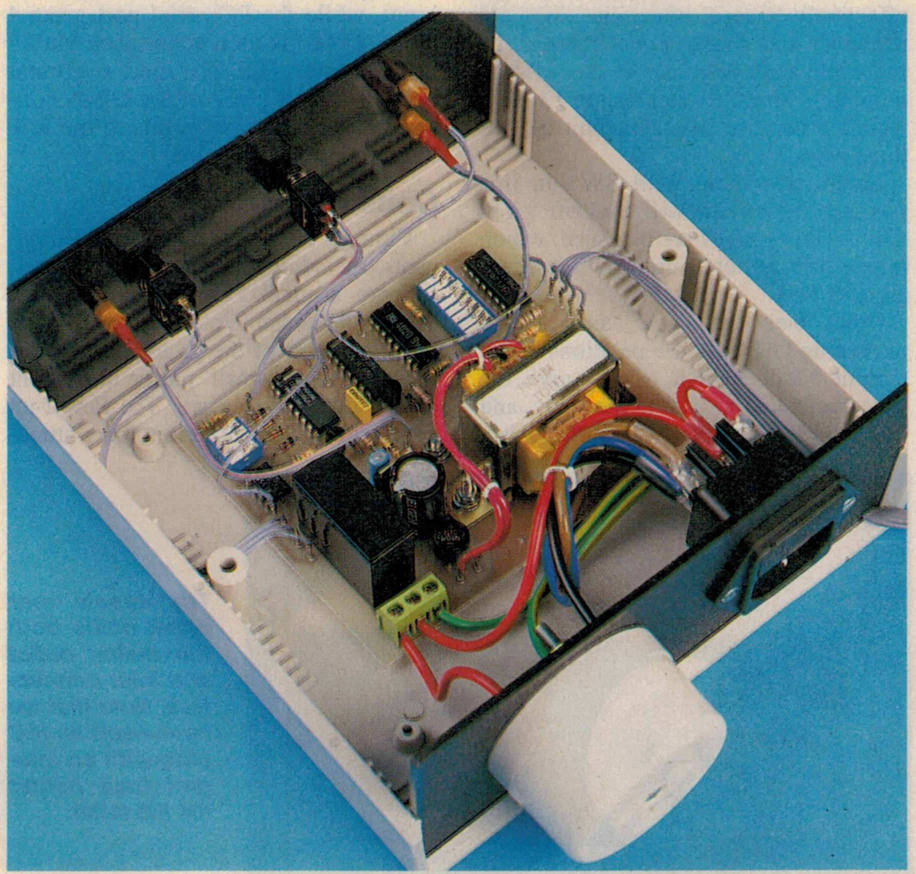
The main timing generator IC3 will count these clock pulses (at pin 10) when its reset input (pin 11) is held at a low level by the output of NAND gate IC5c — that is, when the collectors of both Q1 and Q2 are at a high level. If either collector falls in response to a RI or CD signal however, IC3 will then be held in a reset state for the duration of the signal, and will then commence counting from the beginning of its range.

If we consider the three-ring example mentioned above, you can see that the counter will restart its count three times (at the end of each ring pulse), and will only then move through its full count range after the last pulse — or in effect, when the caller has hung up. IC3 will then activate its Q8, Q9 and Q13 outputs after delay periods of 5, 10 and 163 seconds respectively, unless counting is again reset by further RI or CD signals from the modem.

In the normal sequence of events that follow a call, the five-second output from IC3 (Q8) will firstly gate through the number of rings stored in IC2, as mentioned above. The Q9 output (10s) will then reset IC2 five seconds later, so that the circuit is again ready to count incoming ring pulses — this state is indicated by LED2 ('READY'), which is activated from IC2's Q0 output via limiting resistor R9.

After a further 153 seconds has elapsed, IC3's Q13 output (163s) will then drive IC4's Threshold input (pin 6) to a high level, via the Shutoff Mode switch SW1. Since IC4 has already been triggered into a set state by the 'correct' number of rings in our example (as detailed above), the 163-second timing pulse will therefore cause the 555 to reset.

As a result RLA1, and therefore the 240V AC mains at the Power-up outlet socket will shut off after only two minutes and 43 seconds has elapsed. This is sufficient time for a computer to boot-up and attempt to make contact with a remote modem, so the lack of a Carrier Detect (CD) signal from the local modem means that the attempt has been unsuccessful — the circuit therefore shuts down and returns to its



The Power-up's circuit board assembly fits inside the case with room to spare. Any other case that's used should be of a plastic construction.

reset state, as required.

In the event of a successful contact on the other hand, the modem will produce a CD signal before the circuit has 'timed out'. This immediately resets IC3 via Q2 and IC5c as described, and holds the circuit in the current state (IC4 set, etc) while the CD line is active. The CD signal will ultimately return to a low level when the communications session ends — the remote modem hangs up, or the comms' link is broken — and the circuit will shut down after a delay of 163 seconds, in the normal way.

As you can see from the schematic, the Shutoff Mode switch SW1 can also be moved to the '> 9 RINGS' position, where IC4's Threshold input (pin 6) is connected to the Q9 output of IC2, rather than the 163-second timer output. When this mode is selected the circuit will therefore stay activated until nine rings are received, where the resulting high level at Q9 immediately resets IC4.

Note that Q9 also drives the 4017's CP1-bar input (pin 13), which has the effect of disabling its normal clock input (at pin 14) when the count has reached nine. This is turn means that IC2 will effectively 'freeze' after nine rings are received, and cannot count through its full cycle and cycle back to the selected number of rings. (A call lasting 13 rings would otherwise trigger a unit set for three rings.)

In practice then, with SW1 in this position the circuit will shut off when *nine or more rings* are received, which makes the remote shut-down process an easy task.

Other than that, you can see that remaining ON and OFF positions of the Output Mode switch (SW2) give the user manual control over the relay, and therefore the 240V AC outlet. Also, LED3 (with limiting resistor R12) shows the user that the Power-up's output is active, while D7 quells any backswing voltage from the relay coil during the turn-off cycle.

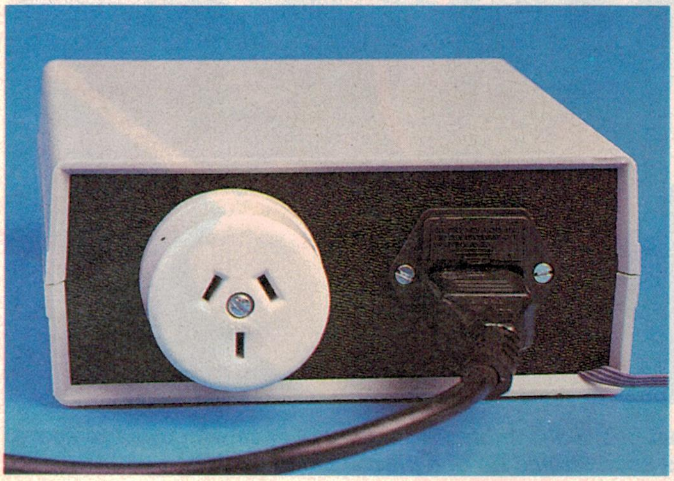
You may have also noticed that the output from IC4 is passed to the RI(PC) output line, via isolating resistor R11. This is used to provide feedback to the computer that the Power-up has been activated by the correct number of rings, and can be monitored by suitable software — more about this at a later stage.

The final section of the circuit involves the unit's power supply, which is a quite conventional arrangement based a 7812 three-terminal regulator IC6. Here, the power transformer's (nominally) 12V AC secondary voltage is full-wave rectified by diode bridge DB1, then filtered by reservoir electrolytic C2. The resulting DC level of around 18V is applied directly to IC6, which in turn delivers a stable 12V supply to the Power-up's circuitry, with final bypassing supplied by electrolytic C1.

Finally, note that the circuit's ground or common connection is tied directly to mains earth at the 240V AC input, while the PC serial port ground point (GND) is then connection via 15 ohm resistor R2. The port's ground point is in fact pin 7 of the DB25 connectors, which corresponds to the RS-232 'signal ground' line.

Construction

Virtually all of the Power-up's components, including the power transformer, fit onto a small PCB measuring 99 x 81mm and coded 97pu6. As you can see from the shots of the prototype, this fits into a standard 'small' plastic instrument case with room to spare. The Power-up could in fact be housed in a more attractive low-profile box, if you prefer.



The case's rear panel holds both the mains outlet and inlet connectors. Note that we have used an IEC plug with an integral fuse holder for the latter.

The limitation here however is the size of the mains outlet socket, which requires roughly 45mm of vertical space on the rear panel of the case. Since all of the unit's other components are rather smaller though, some constructors may wish to use a low-profile box with a 'flying' mains outlet lead. This would need to be solidly secured inside the box, with the flying end terminated in a conventional three-pin line socket.

Before discussing the construction details for the Power-up, we should point out that since it is powered from the 240V AC mains and uses a PC-mount relay to switch that supply, there are lethal voltages inside inside the box when the unit is in use. Also note that unlike most other mains-powered projects, the 240V AC supply is present on the actual circuit board tracks around RLA1's contacts, on the underside of the PCB. Of course as a result, a *plastic* rather than metal case must be used.

In short then, we must reinforce our usual warning to take extreme care when working with mains-driven projects such as the Power-up, and take particular care with the dressing and layout of the mains wiring itself. The unit should not be tested with the 240V mains applied until construction has been completed, with the PCB firmly secured to the lower half of the plastic case and all exposed mains connections fully covered.

With these warnings out of the way, we can now get on with the more agreeable business of covering the Power-up's construction. Since the PCB has been designed to hold all of the circuit's main components, assembling the unit is really quite a straightforward process and should present few difficulties to even inexperienced constructors. As usual though, we strongly suggest that you refer to the component overlay and wiring diagrams at all times.

Begin the process by installing all of the lower profile parts onto the PCB as shown in the overlay. Note that there is a single wire link to be installed near the front of the board, and a total of 18 PCB pins required for the wiring exit points. You will also need to check that the DIP switches are installed with the ON positions facing towards the left, as shown in the overlay — confirm the DIP switch ON setting with a multimeter if necessary.

Other than that, take care with the orientation of all semiconductors and electrolytic capacitors, and as usual, deal with

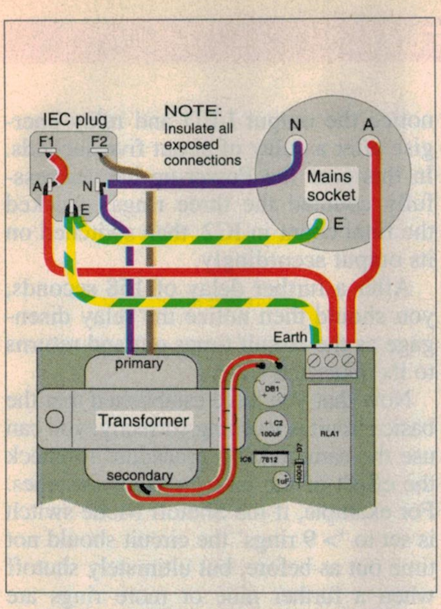
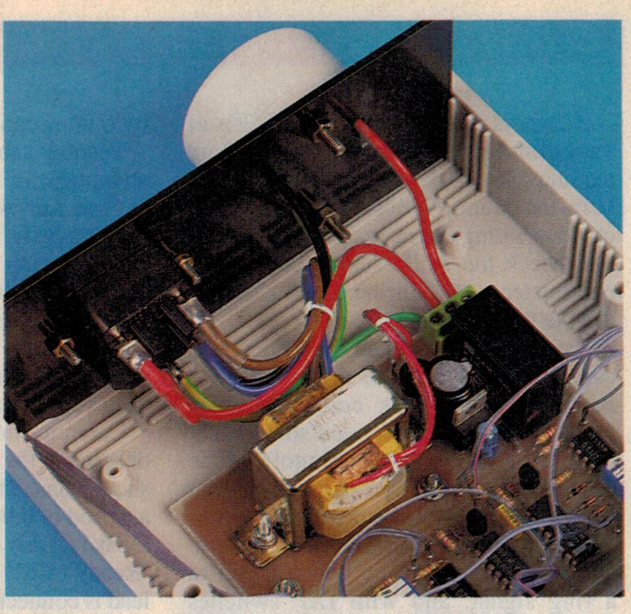


Fig.1 (left): Use this diagram as a reference when completing the Power-up's 240V AC mains wiring. Follow the layout carefully, and cover any exposed connections.
The interior shot on the right shows the completed wiring in our prototype unit.



the higher-profile parts in the latter stages of construction. And by the way, note that the 555 timer IC (IC4) is installed with an opposite orientation to the other ICs, as shown in the overlay diagram.

The power transformer should finally be bolted to the PCB using suitable locking washers, and its two *secondary* leads trimmed and soldered to the PCB pins near BR1. The secondary's remaining centre-tap lead (usually black in colour) should be cut short, and its free end insulated with cambric or heatshrink sleeving.

Finally, double check that the mains/earth PC-mount terminal block is well soldered to all three points on the PCB tracks, and bolt the completed PCB assembly into the lower half of the case. The front panel switches and LEDs can now be wired to the appropriate PCB pins as indicated in the overlay diagram, while the 240V AC wiring should be completed exactly as shown in the associated mains wiring diagram (Fig.1). Use cambric or heatshrink sleeving to cover all exposed mains connection points, and make sure that those that have been soldered are solid and reliable.

Wiring the RS-232 connector

With the Power-up's main module fully assembled, the remaining job is to wire up the unit's in-line RS-232 connector, which is based on a low-cost DB25 to DB25 patch/jumper box. This handy little gadget is constructed from two DB25 connectors (one male, one female) that are held together by a short section of PCB, while the complete assembly is housed in a simple clip-together case.

As it happens this 'universal' jumper box is particularly suited to our project, since its internal PCB has short tracks that connect the RS-232 lines from each DB25 connector to a set of central pads. These pads can be linked to form an RS-232 'straight through' connector, and the CD, RI(M), RI(PC) and GND connections tapped off and sent to the main Power-up unit via four wires.

The way in which the pads should be linked is represented in Fig.2, where as you can see all of the RS-232 signal lines are directly linked with the exception of the RI line — the 'protective ground' line (PG, pin 1) is already wired through. **Note that this diagram is only intended as a guide to the correct wiring for the jumper/patch box, and does not depict the actual PCB tracks which are spread between both sides of the (double-sided) board.**

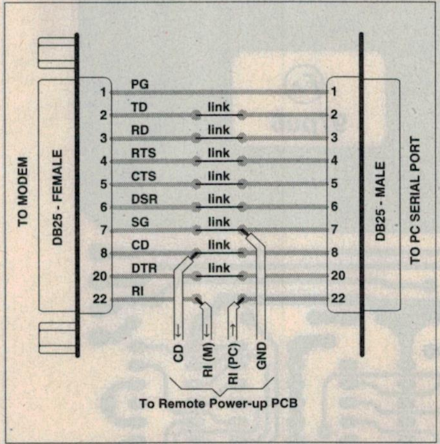


Fig.2: A low cost RS-232 patch/jumper box is wired as an in-line connector by connecting jumper links as shown. Note that the PG line (pin 1) is already wired through, and the RI in and out lines (pin 22) are not directly interconnected.

To complete the wiring as shown, you will need eight short lengths of insulated wire for the links, and a reasonable length (say, around one metre) of four-way cable for the connection to the main unit. We used a four-wire section of IDC ribbon cable for the latter, and this was passed though the in-line connector's case via a narrow slot filed at the meeting surfaces of the two halves. Make this a very narrow slot, so that it acts as a cable clamp when the case halves are clipped together.

The same approach can be used for the cable entry to the Power-up's case, where a small section can be filed off the lower edge of the rear panel. Again, this will clamp the cable in place when the two sections of the box are joined.

As a final word here, take particular care to connect the four RS-232 signal wires in the correct order at both ends, since a mix-up with the wiring may be difficult to track down at a later stage. Also note that the RI(PC) line must go to pin 22 on the computer side of the connector (male DB25), while the RI(M) wire goes to pin 22 on the modem side (female DB25) — hence the 'PC' and 'M' suffixes attached to those line designators.

Initial Checks

With the Remote Power-up now fully assembled, apply power to the unit and check that the 'ready' LED illuminates before about 10 seconds has elapsed. This indicates that the power supply and 50Hz clock signal is active, and the 4017 ring counter (IC2) has been reset by the 4020 timing counter IC3. Next, move the Output Mode switch to the 'On' position and listen for a slight 'click' from the relay as the output on indicator (LED3) illuminates.

If there is no activity from the LEDs or relay, immediately remove power from the unit and check your work — particularly the mains wiring. If there are no obvious wiring errors, re-apply power and first check the +12V supply line with a multimeter, as a fault here will certainly disable the rest of the circuit.

Assuming all is well however, you can now check most of the Power-up's functions before it's connected to a modem and/or PC. The unit should first be configured with the Shutoff Mode switch set to 'After no carrier', so that the circuit will time-out after 163 seconds; with the Output Mode switched to 'Auto' so the Power-up will respond to a ring signal; and with DIP switches DSW1 and DSW2 set as shown on the component overlay diagram. The latter settings make the unit respond to three rings (DSW2) and delay the ring pulse by 0.96 seconds (DSW1).

Testing can now be done by taking advantage of the delay circuit's ability to 'free run' when the RI(M) line is held continuously high — which will simulate a stream of incoming ring pulses. Arrange this by using a clip lead to temporarily connect RI(M) to the V+ rail at a convenient location, such as SW2's upper PCB pin — marked as '+12V' on the overlay diagram.

Carefully hold the lead in place while observing the 'Valid ring' LED, which should flash at about 1Hz, or in fact with a period of 0.96 seconds as determined by DSW1. Also you should also see the 'Ready' LED extinguish when the test lead is connected, and then come on again 10 seconds after the lead is removed.

If the lead is only held in place for the duration of three flashes (three simulated rings) however, you should then notice the output LED and relay energise after a delay of about five seconds. In this case the Power-up has successfully counted the three rings, checked the final count in IC2, then switched on its output accordingly.

After a further delay of 158 seconds, you should then notice the relay disengage as the circuit times out and returns to its quiescent state.

Now that you have established that the basic circuit is working correctly, you can use the same testing procedure to check the effect of the unit's various switches. For example, if the Shutoff Mode switch is set to '> 9 rings' the circuit should not time out as before, but ultimately shutoff when a further nine or more rings are induced with the test lead.

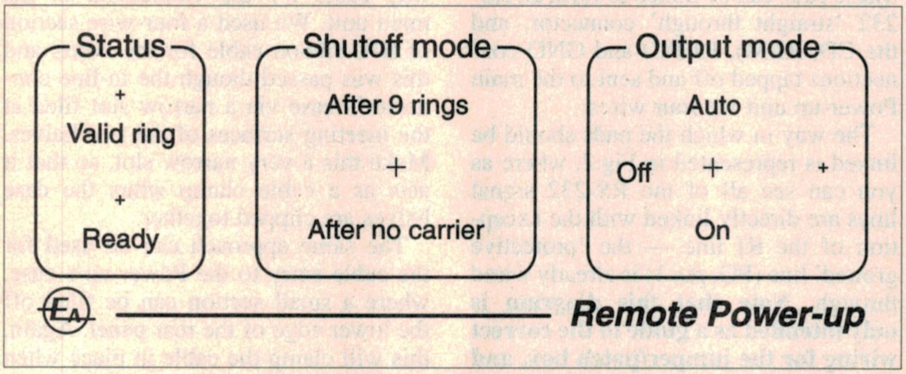
Setting up

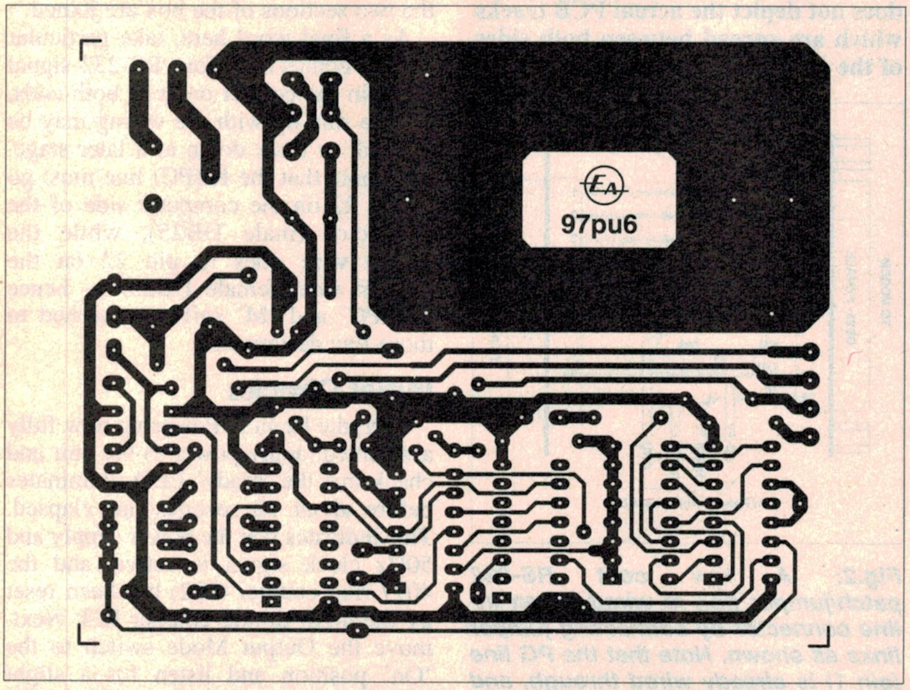
The only setting up to be completed with the Power-up is to adjust the ring delay period (using DSW1) to suit the modem that activates the circuit. As you can see from the table and diagram presented in Fig.3, the DIP switch bank sets the delay in a binary format with switch number four selecting the lowest order bit. With switches 2 and 3 moved to the on position as shown in the diagram then, the delay is set to 0.96 seconds and ring pulses that are shorter than this period will be rejected — this setting seems to suit most modems, by the way.

To check that the current setting is correct for your modem, you will need connect the Power-up's RS-232 box to the modem then watch the response of the 'Valid ring' LED as a call comes in. If the circuit's ring delay is about right, you should see the LED flash quite briefly (say for a couple of hundred milliseconds) at the end of each ring.

On the other hand, if the LED doesn't respond as it should *and* you are confident that the circuit is working correctly, the delay can be adjusted on a trial-and-error basis, by progressively setting DSW1 for a slightly different delay period. By the way, we have also developed a small computer program that analyses the modem's ring pulses during an incoming call, and this can be used to quickly set DSW1 to an optimum value — but more about this in a later article.

With the hardware side of the Remote Power-up organised, you can now connect the unit's RS-232 interface in series with computer's modem lead, connect the PC power lead to the Power-up's 240V outlet and arrange for a 'host' communications package to take over when the





The front panel (top) and PCB (above) artwork shown actual size, for those who wish to make their own.

system is powered up remotely. Programs such as Telix and Qmodem are quite suited to this job, and those particular packages can be downloaded from the *EA* Bulletin Board; call (02) 9353 0627.

We have also produced a small program that will automatically tell the computer to boot up in a different manner, when the Power-up has been remotely activated. This works by monitoring the Power-up's RI(PC) line, and also means that the computer will boot up in a normal way when switched on locally — that is, by setting the Power-up's Output mode switch to 'On'.

In normal use then, the Power-up and modem are always on while the PC can be activated remotely *or* locally, as circumstances demand.

If you are just using the Power-up to remotely switch on some appliance — rather than turning on a PC to establish a remote communications link — you will need to select the 'After 9 rings' shutoff mode, and connect the appliance to the Power-up's 240V AC outlet socket. Bear in mind that in this application there is no feedback as to whether the turn-on call has been successful, so you will need to first establish that the Power-up is reliably processing the modem ring signals. The turn-off sequence is quite straightforward of course, since in this case the number of rings is not critical — you just need to let it ring *more* than nine times.

Whichever way you intend to use the system though, you will need to make sure that the Power-up is counting ring pulses in a predictable manner. The system was tested with quite a wide range of modems, and we found that thanks to the adjustable nature of the delay circuit this was indeed the case. We had trouble with just one modem by the way, and this turned out to be because it produced an extra full-width ring pulse with each call. We just moved DSW2 up one notch in order to compensate...

That's about all we have space for in this issue. In the next installment we'll discuss how to use our home-grown utility programs with the Power-up, and suggest a few ways that the system can be setup with existing communications software — *and* Windows 95... ❖

PARTS LIST

Resistors

R1,9,12	2.2k
R2	15 ohms
R3,6	27k
R4	82k
R5,7,8	15k
R10	15K
R11	2.7k
R13	100k

Capacitors

C1	1uF 16VW electrolytic
C2	100uF 25VW electrolytic
C3	10nF MKT electrolytic

Semiconductors

IC1,2	4020 binary counter
IC3	4017 decade counter
IC4	555 timer
IC5	4093 quad Schmitt NAND gate
IC6	7812 3-terminal +12V regulator
Q1,2	BC548 NPN transistor
D1-6	1N914 diode
D7	1N4004 diode
DB1	W04-type 1A diode bridge
LED1-3	red, green, yellow LEDs

Switches

SW1	DPDT mini toggle
SW2	Centre-off DPDT mini toggle
DSW1	4-way DIP switch bank
DSW2	8-way DIP switch bank

Miscellaneous

T1	12.6V 150mA power transformer
RLA1	SPDT 10A relay, 12V coil

RS-232 male to female jumper/patch box, 3-way PC-mount terminal strip,
IEC male panel-mount socket with built-in fuse holder, 250mA M-205 fuse,
panel mount mains socket (female), plastic instrument case to suit,
PCB coded 97pu6 (99 x 81mm), hookup wire, IDC ribbon cable, PCB pins, nuts and bolts.

Special 'nostalgia' project:

BUILD AN OLD TIME ONE-VALVE RADIO - 2

Here's the second of two articles designed to help you build an authentic one-valve radio: a regenerative circuit with surprisingly good performance. In this article the author covers winding the coils, assembling the components and getting it all going. He also explains how to operate it to get the best results.

by PETER LAUGHTON

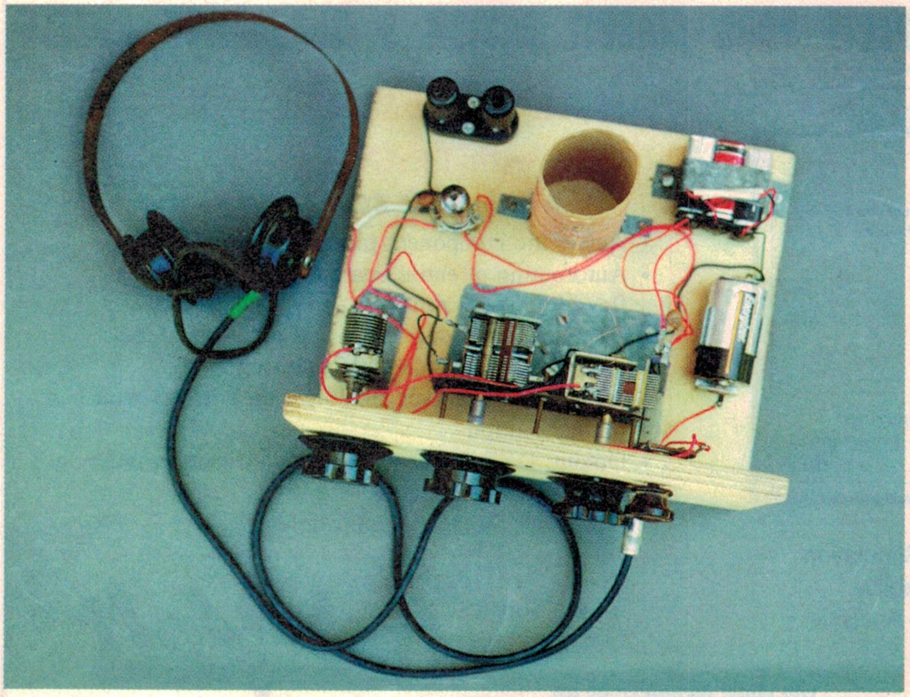
To guide you in building the receiver, Fig.7 gives details of a typical layout and placement of parts. Note, however, that the placement of parts is not critical and almost any layout that will accommodate them can be used.

Start by obtaining two flat pieces of wood. I used five-ply, but other materials like chipboard or MDF will work. My front panel was 10" x 6" and the base was 10" x 8" (this is supposed to be an old time project, so no metric dimensions are given; but multiplying the inches by 25 and calling it mm would be close enough). The two were glued together and then nailed, giving an L-shaped chassis with the 10" x 6" piece becoming the front panel.

Next the holes were drilled for the three tuning capacitor spindles, along with a 1/2" hole for the headphone socket and a smaller one for the power switch. These items were then mounted on the front panel, and some L-shaped brackets made from scrap tin plate to mount the tuning capacitors on the base, in the correct positions. (Old fruit tins can be recycled here!)

Next came the valve socket, mounted on the baseboard using a couple of one-inch long 1/8" machine screws with extra nuts used to space it up and allow access to the connection lugs (which were bent outward at about 45°, to make soldering easier).

The aerial/earth terminal block was then screwed to the back of the baseboard, and the 1.5V 'D' battery holder up the other end behind the power switch. Then a couple of small brackets were cut from the same fruit tin to hold the three 9V 'B' batteries.



Another view of the author's prototype, showing the general layout he used.

My coil was wound on a section of cardboard mailing tube, but you could also wind it on a 125mm length of 50mm-diameter PVC pipe if you prefer. Either way, use the information in Fig.8 as a guide. I used some enamelled copper winding wire from a defunct video recorder head motor, but there are many other such sources around to buy or scrounge some small diameter wire. (Firms like Dick Smith Electronics will sell you rolls of it.)

Several coils were wound and tried, with wire from 1mm in diameter to 30 gauge (very fine). All worked satisfactorily, and if you can get hold of some old-style 'Litz' type wire, slightly better results will be obtained on the broadcast band with better results on short wave.

Make sure that all the windings are wound in the same direction. The dots on the circuit diagram in Fig.6 indicate the start (or finish if you want) of each winding. Just keep the windings in the same direction and enjoy winding the coils.

To wind on the turns, start by drilling two holes in the end of the tube, about 8 to 10mm apart. These will be to anchor the wire. Thread one end through both holes such that the wire reappears on the outside of the tube, then wind on about 25 turns. Drill another two holes as before, and cut off enough wire to feed through the holes. This is the aerial winding. (A small piece of Sellotape helps here to hold the winding in place).

Now drill two more holes adjacent to these last ones, and once again thread the wire through them. This time wind on 30 turns, and drill two more holes to act as anchor points. Make a small loop in the wire, to form a tapping, but don't cut the wire short. This centre tapping will be used later to 'reflex' the receiver. As this is the main tuning winding, wind on another 30 turns, making 60 in all. Then

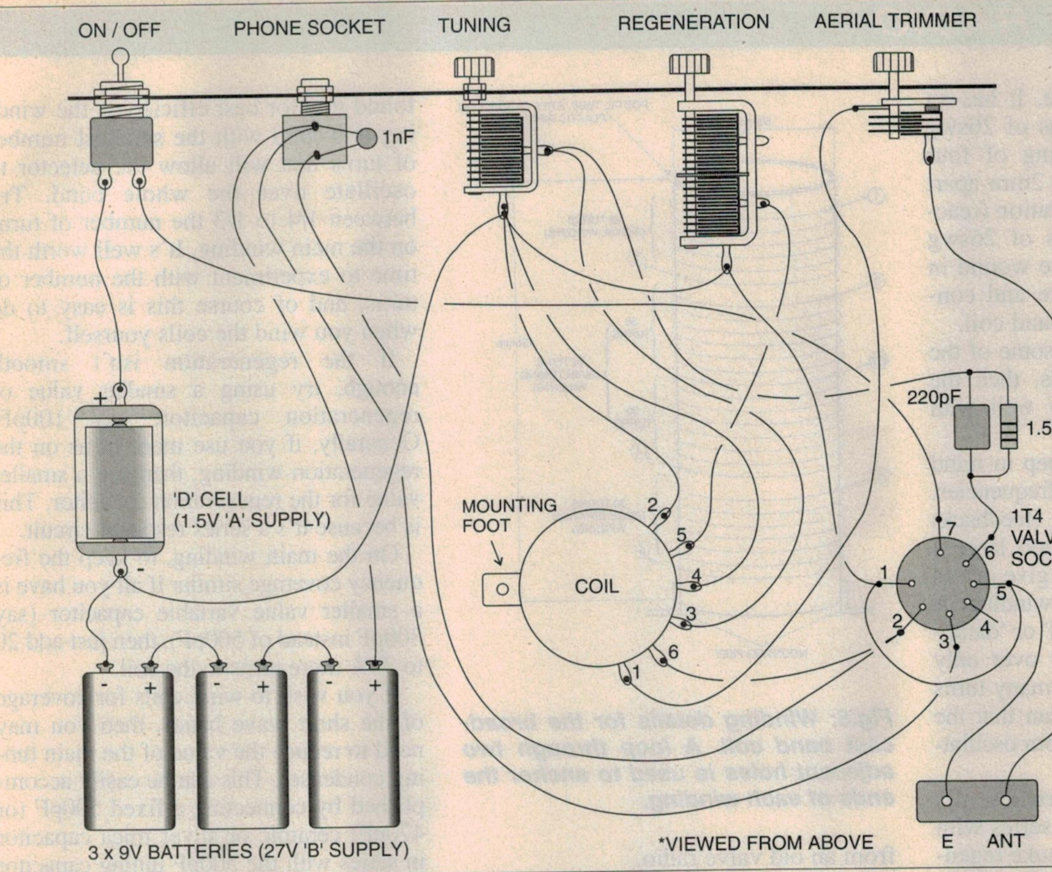


Fig.7: The author's wiring in detail, for the radio built using a 1T4 miniature valve. The exact layout is not critical, especially if you build the set for the AM broadcast band.

drill another two small holes and anchor the wire as before.

Finally, drill two more holes and wind on the feedback winding of 30 turns. Drill a final two holes and anchor the wire.

Don't worry unduly if the wire breaks as you are winding it on; second-hand wire tends to do this as it may be kinked, etc. Just solder it back together and keep winding.

The actual construction takes less time to do than to describe. Also, a few more or less turns don't matter, as the tuning capacitor generally has enough adjustment range to compensate.

There are several ways to mount the coil on the baseboard, from some small tinplate L-brackets to a piece of timber the same diameter as the coil and screwed to the baseplate. Try to keep large bits of metal away from the windings though, as the coil's efficiency will be decreased by any in the vicinity.

Finally the other miscellaneous components are fitted, and everything wired up using Fig.7 as a guide. Note that the 1.5M grid-leak resistor and its bypass capacitor are wired directly in place between pin 6 of the valve socket and the tuning capacitor stator lug.

When finished, leave the valve out of its socket and connect the 1.5V and 9V batteries up. To test that the wiring is OK, connect a 2.5V torch bulb temporarily in place of the valve by soldering short lengths of wire to its terminals and poking them into the filament holes on the socket. For the 1T4 these are pins 1 and 7. If the bulb just glows red, that's OK; if it blows then you have a problem — but luckily bulbs are cheaper than valves!

If all was well, turn off and fit the valve. Then connect the wireless to a aerial at least 10 metres long, and a decent earth — not a mains earth if you can avoid it, as these can have a small voltage drop across them and cause hum in the headphones. Use a wire clamped to a water pipe (scraped clean first), if you possibly can.

To start with, set the aerial trimmer to maximum (closed) capacity and the regeneration capacitor to minimum (fully open). Then slowly turn the regeneration control until the set breaks into a squeal (oscillates), and back it off a bit until the squealing stops. Now operate the tuning capacitor to look for a station, whilst at the same time adjusting the regeneration control as necessary to ensure that the set is *not* oscillating, but as close as possible to the point where it would. (That's the condition of maximum gain and selectivity.)

When you find a station, adjust the aerial trimmer for maximum volume (or minimum interference from adjacent stations) and then just nudge the regeneration control a bit to get maximum sensitivity without oscillation.

It probably sounds complicated, but it's really quite easy and after a few minutes of use it becomes second nature.

If you can't get the set to squeal at all, then try reversing the connections to the regeneration winding (5 and 6 on the circuit in Fig.6). There really isn't much that can stop it from working apart from flat batteries or faulty headphones.

The same basic circuit can operate from the broadcast band up to the VHF (144MHz) bands. Indeed 70 years ago the only type of receiver that could be easily and cheaply built to operate above 30MHz was the regenerative type like this. All that's needed to adapt the receiver to shortwave listening is to use a different coil, and perhaps add a small 'fine tuning' capacitor in parallel with the main tuning capacitor to make tuning easier.

Different coils

Winding a coil for covering the short wave bands up to about 15MHz is quite easy. The former can be increased in diameter, to improve its efficiency, while at the same time the number of turns in the windings are reduced. Broadly speaking you reduce the number of turns in each winding to increase the frequencies tuned, and by about the same factor — keeping the ratios between the three windings the same as before.

I used a former 2.5" (60mm) in diam-

eter, made from postal tube. It has an aerial winding of three turns of 26swg wire, a main tuning winding of four turns of 18swg wire spaced 2mm apart between turns, and a regeneration (reaction) winding of four turns of 26swg wire. All of the windings are wound in the same direction as before and connected as for the broadcast band coil.

Incidentally if anyone has some of the Denco range of tuning coils, then the green range will work very well with these sorts of receivers.

Here are a few notes to keep in mind when winding coils for other frequencies. When altering the reaction (feedback) winding, keep in mind that too large a winding (too many turns) can give just as much trouble as too small a winding. A large winding will tend to 'kill' or 'dampen' the oscillation, generally over only some of the wavebands. Too many turns on this winding will also mean that the receiver is difficult to keep from oscillating and may be unstable.

On the short wave frequencies, it's wise to use the RF choke in series with the headphones, as this will make regeneration smoother. However if you do use an RFC, then the value of the feedback capacitor (regeneration control) will have to be reduced. It's easy to make a small-value capacitor by removing about half of the plates from a old broadcast tuning capacitor, removed

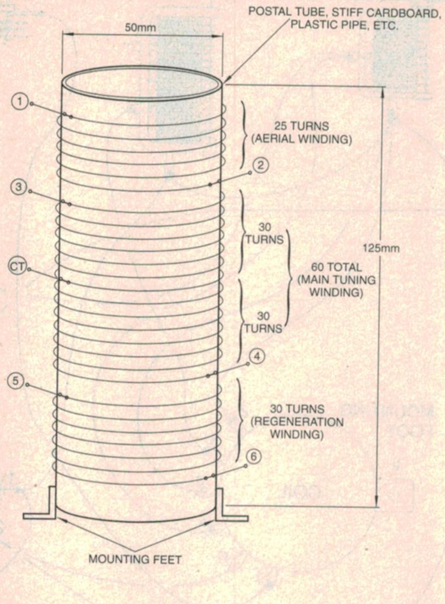


Fig.8: Winding details for the broadcast band coil. A loop through two adjacent holes is used to anchor the ends of each winding.

from an old valve radio.

It was customary in the 1930s to make the reaction winding with about 2/3 to 3/4 as many turns as the main winding. I suspect this was done to allow for reliable oscillation with the relatively low-gain valves available then. With the types of valves available today, it will be found that for best efficiency, the winding is wound with the smallest number of turns that will allow the detector to oscillate over the whole band. Try between 1/4 to 1/3 the number of turns on the main winding. It's well worth the time to experiment with the number of turns, and of course this is easy to do when you wind the coils yourself.

If the regeneration isn't smooth enough, try using a smaller value of regeneration capacitor, say 100pF. Generally, if you use more turns on the regeneration winding, then use a smaller value for the regeneration capacitor. This is because it's a series resonant circuit.

On the main winding, to keep the frequency coverage similar if all you have is a smaller value variable capacitor (say 300pF instead of 500pF), then just add 20 to 30% more turns to the coil.

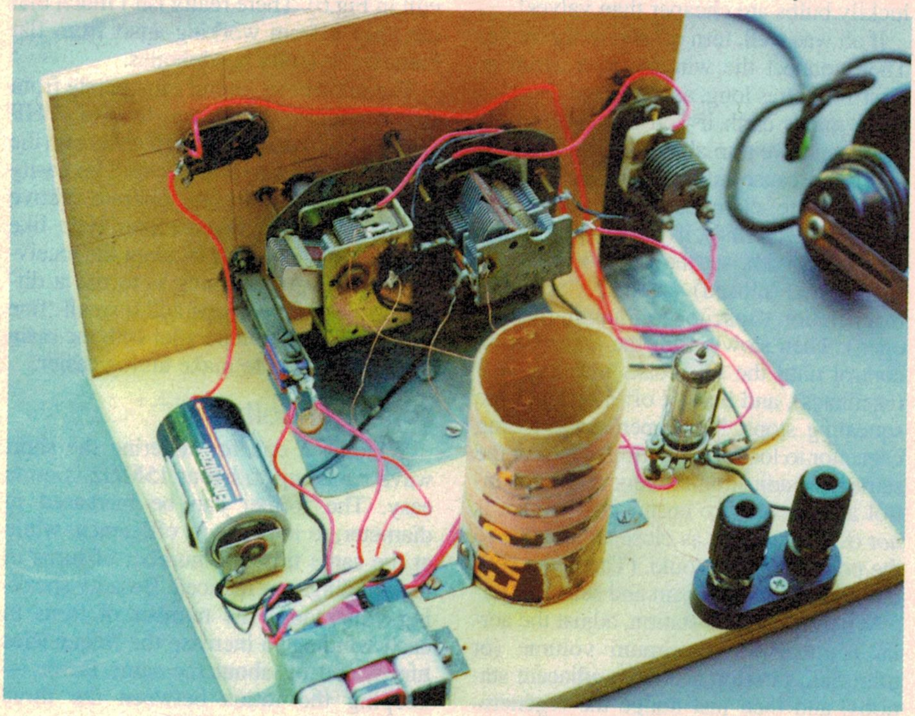
If you wish to wind coils for coverage of the short wave bands, then you may need to reduce the value of the main tuning condenser. This can be easily accomplished by connecting a fixed 500pF (or 470pF) ceramic or silver mica capacitor in series with the 500pF tuning capacitor unit. This will drop its value to 250pF, which will restrict the tuning range a bit.

For operation on the higher short wave bands, say above 10MHz, the main tuning capacitor can be reduced to 200 or 300pF, and the regeneration capacitor reduced to say 100pF. This will enable you to increase the number of turns on the coils, giving a smoother control. The grid leak capacitor can be reduced to 100pF or less and the grid leak resistor can be increased to 5MΩ or greater. A variable resistor could be used for the grid leak, and its adjustment, whilst not critical, can affect the overall 'tone' or sound of the receiver.

Smoother regeneration

Try connecting a 250kΩ variable resistor in series with the screen grid. By-pass this with a 0.1uF capacitor to reduce the electrical noise that's generated when operating the potentiometer. This is shown in Fig.9. The effect of this is to give more stable control of regeneration, but it also adds another control. (Four hands are needed now!)

Ideally, the regenerative detector should go into and out of oscillation smoothly, with no effect on the frequency of that oscillation. It would not be affected by hand capacity, would give the same value of regeneration regardless of the frequency used, and not be affected by the aerial swaying in the breeze (changing aerial capacitance to earth and therefore



A closer view from the rear, showing more of the wiring detail and also how the valve socket is mounted up from the baseboard.

its loading). But in a practical design, these requirements are often conflicting.

Regardless, it is best to wind the 'tickler' or feedback winding of the tuning coil at the ground or cathode end of the main tuning or 'grid' winding. Use as few a number of turns as necessary to get the detector to reliably oscillate over the whole tuning range desired.

If the valve breaks into oscillation suddenly as the regeneration is advanced — i.e., is uncontrollable — try altering the value of the grid leak resistor to a higher or lower value. Also, operating the valve with too high a plate voltage or, in the case of a pentode, too high a screen voltage will cause this problem.

When connecting an aerial, the tighter the coupling (or higher the induced signal) the more regeneration will be needed to achieve good selectivity. So try changing the number of turns on the aerial coupling winding. A small series aerial condenser, as mentioned before, can also be used in the aerial circuit to reduce these effects.

If you are using an aerial whose length is approaching resonance at the frequency you are listening on, then the absorption of energy from the detector will increase and it may not be possible to get any regeneration. This should only occur with really large aerials, say over 50 metres long. In any case, using such a long aerial with these simple detectors will result in overload from local stations, unless you live in the bush and don't have any powerful radio stations nearby.

Overloading problems from strong local stations can be sometimes fixed by connecting the aerial to a tapping on the aerial coil, or even a separate smaller winding (i.e., fewer turns) wound over the main aerial winding. This reduces the aerial coupling and makes the coupling from the aerial to the grid of the valve 'looser'.

Several other effects may be noticed. The first of these is drifting due to the presence of your hand. This is caused by your body's capacitance and manifests itself by not being able to keep the station in tune when you move your hand away from the receiver.

Several things can be done to minimise this effect. The easiest is to make sure that the set has a good RF earth path. Check whether the earth isn't efficient by moistening your finger and placing it on the radio's earth terminal. Any change in the signal strength or drift is evidence of an inefficient earth connection. The cure to this may mean a separate metal earth stake, driven into a moist position and connected to the receiver.

Altering (usually reducing) the value of the small aerial coupling capacitor mentioned above can also prevent this

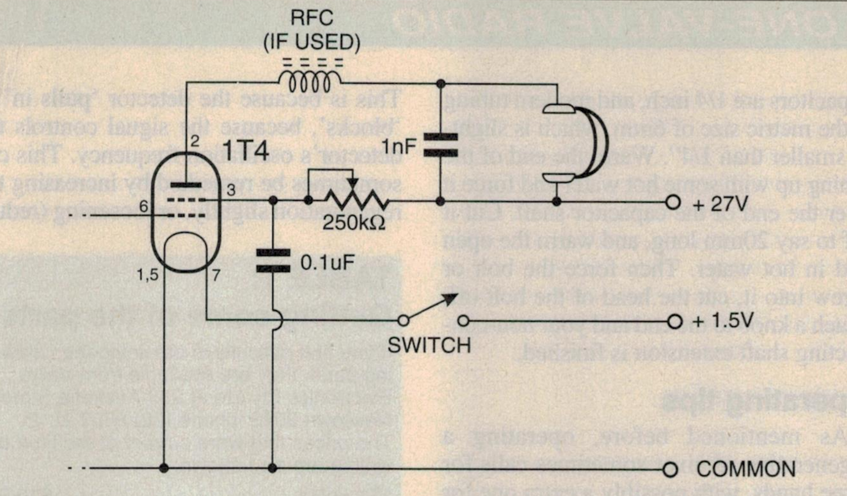


Fig.9: With pentodes, smoother regeneration control can be achieved by using a pot in series with screen grid.

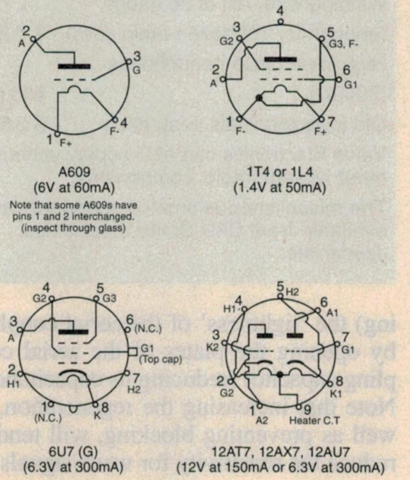
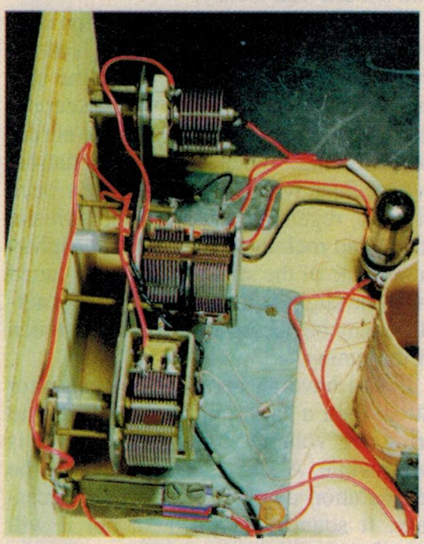


Fig.10: Base connection diagrams for the various valve types that can be used in the receiver. All are shown viewed from below.


This shot shows how the capacitor spindles are extended through the front panel — see text.

effect, as the aerial coupling may be too 'tight' or the aerial too long. RF filtering of the headphone leads with small series RF chokes and a 1nF capacitor across them can help.

Sometimes hand capacity effects are caused by leakage in the RF choke, and one with more windings or a greater inductance can also help. Just make sure that the DC resistance of it isn't too high, or too much high tension voltage will be dropped across it.

If all these measures fail, then screening of the front panel of the receiver is necessary. A separate metal (galvanised, copper, aluminium, or a piece of unetched PCB laminate etc) shield can be made up and fitted 10mm or so behind the front panel. The three tuning controls can be brought out through this panel with insulated extension shafts (say nylon, ebonite or Bakelite). This panel must be connected to a good earth connection.

If this is too difficult, then lining the inside of the cabinet with aluminiun foil and connecting it to the earth terminal can help. If you are using an audio amplifier with the receiver, then connecting a RF choke in series with the power supply to it can also help.

It is easy to make up insulated extension shafts for the tuning capacitors. All that's needed is a small length of stiff but flexible plastic tubing as used in the fuel system of diesel vehicles, and an aluminium screw or bolt of the same diameter as the shaft of the capacitor.

Usually, most shafts on older type of

capacitors are 1/4 inch, and modern tubing is the metric size of 6mm, which is slightly smaller than 1/4". Warm the end of the tubing up with some hot water and force it over the end of the capacitor shaft. Cut it off to say 20mm long, and warm the open end in hot water. Then force the bolt or screw into it, cut the head of the bolt off, attach a knob to the end and your non-conducting shaft extension is finished.

Operating tips

As mentioned before, operating a regenerative receiver sometimes calls for three hands, with possibly a extra one for adjusting the volume control if you are using an audio amplifier! That said, it's not difficult and after a few minutes use, you should find it easy.

I begin by turning the regeneration control until a hiss or even a whistle is heard in the headphones. Then I move the tuning capacitor very slowly, whilst keeping the regeneration control just on the border of oscillating. When you pass a station, the receiver will whistle; you then back off the regeneration until the whistle stops, and rock the tuning control slightly either side of the station. When it's tuned in, some slight adjustment of the regeneration may be necessary, then a final touch of the tuning.

If you have an aerial tuning capacitor fitted, then a slight adjustment of this to bring the volume to its loudest level is worthwhile. A slight readjustment of the regeneration control may be then necessary. It sounds complicated, but it will soon be second nature.

It's not good practice to operate the receiver with the regeneration control causing the detector to oscillate, as this will cause interference to adjacent radios.

The radio is capable of receiving both SSB and CW signals as well. To tune in these types of transmissions, the regeneration is advanced until it just starts to oscillate. This will be noted by an audible 'hiss' or even whistling in the headphones. At this point the SSB signal can be tuned in with the tuning dial, and the regeneration adjusted to peak the signal strength. Both controls need to be adjusted together as they interact with each other.

If you operate the detector into regeneration too far, as well as causing interference, the battery and valve life will both be reduced and the detector will not be operated at its most sensitive point.

Note that when listening to a CW signal, there will be a point where the signal seems to disappear into a zero beat, and a low pitched beat note can't be obtained. This is because the detector 'pulls in' or 'blocks', because the signal controls the detector's oscillation frequency. This can sometimes be remedied by increasing the regeneration slightly, or loosening (reducing) the 'tightness' of the aerial coupling by opening the plates of the aerial coupling capacitor (reducing its capacitance). Note that increasing the regeneration, as well as preventing blocking, will tend to reduce the sensitivity for weak signals.

TABLE 1: Getting some of the parts

If you find difficulty in obtaining the following parts, they are available from Valve Electronics Pty Ltd at 239 Australia Street, Newtown 2042; phone (02) 9557 2212. The prices that were current at the time of writing are also shown:

1T4 valve	$10.00
Socket to suit	$ 1.50
Two ganged tuning capacitor (only one gang used)	$ 7.50
Old style knobs, each	$ 5.00
Winding wire, roll of 26 gauge (enough for 1/2 dozen radio coils)	$ 7.25
High impedance headphones (2000Ω)	$60.00
Old style terminals post, each	$ 3.50

Valve Electronics can also supply various other 'vintage radio' components.

The miscellaneous small components are available from Dick Smith Electronics, Jaycar etc.

Refinements

A slow motion dial can be added to the tuning control to make it easier to operate. If you wish, one can also be added to the regeneration capacitor as well, but it's not really necessary.

Instead of a slow motion dial, a small variable capacitor of about 50pF or so can be added in parallel with the main tuning capacitor. This will give a 'bandspread' action, or spread out the range of the main tuning dial. To operate this way, set the main tuning dial to approximately the setting you wish to use, and the operate the bandspread dial instead of the main tuning dial. The reaction control should be operated the same way as before — i.e, follow the main tuning dial across the band, keeping the receiver just on the verge of oscillating.

A small variable capacitor of 20pF or so can also be put in parallel with the regeneration ccapacitor to give improved control. (Now six hands will be needed!)

An old ferrite rod aerial from a dead transistor radio was also tried, with the oscillator winding becoming the aerial winding and the original aerial winding the main tuning winding. (The oscillator winding is the one with the least number of turns). Another 20-odd turns were added to the end of the rod for the feedback winding.

If enough interest is shown, an article may follow giving details of an audio amplifier, based on the same range of battery valves. A further refinement may well be an RF stage, giving a TRF or tuned radio frequency receiver of the type that was top of the line and all the rage in the 1920s. We could also try reflexing of the single valve to give loudspeaker reception of local stations from one valve.

Calibration

There are several 'frequency standard' shortwave stations on frequencies from 3MHz to 15MHz. As these are very stable and on known frequencies, they can be used to calibrate the receiver. Be aware though that the calibration of your receiver will vary a little, depending on the amount of regeneration that is being used and the length of the aerial.

Performance

The performance of such simple sets can be quite outstanding. Indeed, worldwide reception of broadcast stations was commonplace in the 1920s using almost identical circuits.

The performance of the set shown in the photos is amazing, considering the small number of parts used. It's superior to that of a radio based on the ZN414 IC radio chip, and, in terms of sensitivity, is much better than that of a typical $5.00 Japanese transistor radio — except that we are using headphones and not a loudspeaker.

If you happen to live within 7km or so of a AM broadcast station, then this receiver could give loudspeaker reception of the station if a suitable speaker coupling transformer were used.

At the writer's own location on the south coast of NSW, about 120km south of Sydney, daylight reception of all the Sydney AM radio stations was possible, with some interstate stations quite clear in the headphones at night. Some NSW regional stations were audible during daylight, such as Dubbo and Kempsey.

All the local AM radio stations were crystal clear, with no sign of interference, and it was easy to differentiate between stations. there was no overlap of any of

(Continued on page 87)

SHORTWAVE LISTENING

with Arthur Cushen, MBE

Seventy years of Dutch Radio

It was in 1927 that the Philips factories in Eindhoven started experimental broadcasting and in 1928 Edward Startz, the originator of their 'Happy Station' became their announcer. Later this year Radio Nederland as it is now known, broadcasting from Hilversum, Holland is to celebrate 70 years of its international service.

The original Philips experimental station PCJ was the forerunner of the present Radio Nederland, and played an important role in promoting shortwave and in achieving better reception. It had a large rotary aerial at Huizen, which consisted of a circular track with masts on either side. The aerial was slung between the masts and the whole setup could be rotated, so that signals could be directed to any part of the world.

Eddy Startz was well known before the war for his bright presentation. He used the slogan "Peace, Cheer and Joy", made up from the station's call sign, to promote the Happy Station programme.

At the outbreak of war in 1940, the Dutch blew up their transmitter and the famous antennas, rather than permit the equipment to fall into the hands of the Nazis. The Gestapo moved in, rebuilt the station with forced labour, and used it to disseminate German propaganda overseas.

Shortly after the Allied invasion in 1944, clever Dutch engineers sabotaged the antenna mechanism so that for the remainder of the war all Nazi broadcasts from Holland were beamed to the North and South Poles. No doubt the polar bears in the Arctic regions enjoyed excellent reception!

When the Nazis left Holland, they pillaged and looted everything of value, including the Happy Station's library of 5000 recordings collected from all over the globe. They also blew up the station again, but when Liberation came the undaunted engineers rebuilt it in record time and PCJ resumed its Happy Station broadcasts to the world.

Radio Nederland

After the entire country was liberated, plans were under way to create a proper external service in several languages, and by April 1947 the Radio Nederland foundation was officially inaugurated. During the early days the transmitters were located at Lopik, and in 1969 it opened its own facility on Bonaire, followed by Madagascar in 1972 and Flevo in Holland in 1987.

The Flevo transmitting site is actually six metres below sea level, built on reclaimed land, and consists of four 500kW transmitters, while on Bonaire there is one 300kW and two 250kW transmitters. Madagascar has two 300kW units. Radio Nederland was one of the first international broadcasters to link their studios in Hilversum with their overseas transmitters by satellite.

Radio Nederland operates 24 hours a day in English and the transmissions are in 55-minute blocks, to suit evening reception across the world. In the South Pacific the broadcasts are 0730-0825, 0830-0925 and 0930-1025. During this period the transmitters from Bonaire are used as well as several transmitters in the former Soviet Union. The programme always opens with news, 'Newsline' which is a digest of international reports and a feature programme. Regular shortwave listeners will also be aware of Media Network on Thursdays at 0752 and 0952UTC. This replaces long running programme 'DX Juke Box' which started in 1958 and was replaced in 1982 when Jonathon Marks took over this programme.

The RN programme schedule and background to its upcoming services is available in a booklet *On Target*, which is issued each six months and is available from the English Section of Radio Nederland, PO Box 222, Hilversum JG 1200, Holland. As well as broadcasting in English there are comparable transmissions in Dutch and also broadcasts in French, Indonesian, Portuguese and Spanish. The programmes are also carried on satellite and available on WWW and e-mail, the address being **letter@rnw.nl.** ❖

AROUND THE WORLD

GEORGIA: Tbilisi, Voice of Hope is now using a transmitter in this country in English 1900-2100 on 7520kHz. At times it has a hum on the frequency, but is otherwise excellent and is VoH's fourth transmitting site. Others are in Lebanon, Palau and Los Angeles. The address is Voice of Hope, PO Box 109, HR4 9XR, England.

GUYANA: The latest schedule is 0757-1100 and 2300-0300UTC on 3290 and 5950kHz.

INDIA: AIR Shimla verifies by letter and lists the schedule. The power is 100kW on mediumwave (774kHz) and 50kW on shortwave.

MONGOLIA: Radio Ulaanbaatar has cancelled its 0930 transmission to this area, but lists two transmissions to Australia and now announces as the Voice of Mongolia, 1330-1400 on 12,085kHz and 1530-1600 on 9745kHz and 12,085kHz. It broadcasts to Europe 1930-2000UTC on 9745kHz and 12,085kHz.

NORWAY: Oslo broadcasts to New Zealand at 00600 on 7295kHz; at 2000 on 9590kHz; and at 2100 on 11,675kHz. English is on Sunday at 0600UTC. Transmission is for 30 minutes and on the half hour the programme is of Radio Denmark.

NEW ZEALAND: Radio Reading Service ZLXA in Levin, which uses 1602, 3935 and 7290kHz celebrated 10 years of operation on Friday May 9th. ZLXA has a new DX programme called 'Kiwi DX', on the third Tuesday at 0730 and repeated the following Sunday at 0330UTC.

SAIPAN: KHBI broadcasts to the South Pacific 0900-1000 on 13,840kHz; 1000-1100 on 15,725kHz; 1100-1300 on 9430kHz; 2000-2100 on 11,860kHz and 2100-2200 on 13,840kHz.

TURKEY: The new schedule for Ankara's Voice of Turkey shows: 0400-0500 on 7100kHz, 7340, 9685 and 17,705kHz; 1330-1430 on 9445kHz and 9630kHz; and 1930-2030 on 5965kHz and 6000kHz.

USA: Radio Free Asia confirmed reception with a letter. The address of the station is 2025 M Street, N.W. Suite 300, Washington DC 20036. The schedule in Mandarin is: 1500UTC on 6240kHz, 7495, 7530 and 9455kHz; and 2300UTC on 6240kHz, 7495, 7530 and 13,800kHz. Further broadcasts are in Vietnamese and Burmese; Khmer and Laotian are also being broadcast.

World Harvest Radio in South Bend, Indiana, has announced plans for a log-periodic aerial at its KWHR site in Hawaii, and a further transmitter which will be used to beam programmes to the South Pacific. Future plans are for a relay base in the Caribbean.

VOA in Delano is now carrying the Radio Free Asia Mandarin Service, from 2300-2400 on 11,970kHz. This is the first use by Radio Free Asia of a VOA transmitter; the other transmitters in Thailand and the Philippines cannot be used because the Governments are opposed to the operation of RFA. ❖

This item was contributed by Arthur Cushen, 212 Earn Street, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind New Zealand Standard Time.

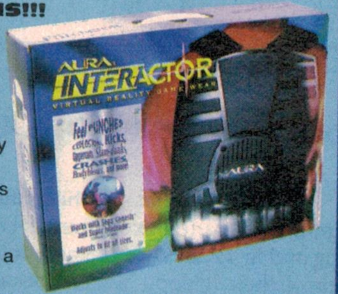
JAYCAR ELECTRONICS — JUNE BARGAINS

Prices valid until 30th June 1997

SCOOP PURCHASE OF THE DECADE

IF YOU THOUGHT SUB-WOOFERS WERE LOW - WAIT FOR THIS!!!

AURA INTERACTOR



A couple of years ago a well-known local company imported a product that they thought would take the market by storm. It didn't, not because the product wasn't any good - it was just too expensive. The product was called "AURA INTERACTOR". It is basically a device that you strap to your body to give an extra dimension to listening to Hi Fi, watching a video, experiencing a computer simulation or game or playing a video game etc. What is this extra dimension? You strap this thing on you and experience - through your body - the punches and kicks from martial arts games, explosions and subsonic roar through home cinema or TV games, tackles, slam dunks etc. The heart of the system is a substantial electromagnetic transducer which is like a speaker but without a cone (see box). The transducer is mounted inside a rigid plastic enclosure which straps on to you just like a back pack. A lead from the back pack connects to a filter/amplifier. The filter/amp then connects to your program source which could be:

- **TV or VCR**
- **Laser Disc Player**
- **CD Player**
- **Walkman**
- **Video Game Console**
- **Hand Held Game**
- **Computer Sound Card**

In fact any audio source which you know has some low frequency information.

The special amp not only filters out extraneous audio, a frequency shifter will divide the frequency of the bass signals by four to intensify the effects of the pulsations. The amp is rated at 21 watts RMS which might not sound like much but has a 70 watt peak rating which is more meaningful as it only operates when it needs to!

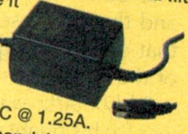
A comprehensive range of adaptor leads and plugs are supplied which includes specific adaptors for:

- **Super Nintendo** • **Sega Genesis I** • **Sega Genesis II**
- **Some Computer Sound Cards** • **Walkmans**
- **Many other amplifiers, video players etc.**

Other standard (ie. part of Jaycars range) plug adaptors and leads will almost guarantee compatibility with your source material. A substantial 30VA power supply is also included.

THIS IS AN EXPERIMENTERS DELIGHT:

Not only is the AURA INTERACTOR distress stock buy a wonderful opportunity to get some subsonic transducers at a bargain price. You also get a brand-new one channel amplifier that will deliver about 20 watts RMS into 4 ohms. This amp has special filters that can be used to make it into a subwoofer amplifier. They can be bypassed of course! Not only that a massive plug pack transformer is also included. It gives 2 x 11.5V AC @ 1.25A. This is ideal for a ±12V 1.25 Amp power supply! Very handy! Quite frankly there is well over $50 value in this deal.



THE ELECTROMAGNETIC TRANSDUCER:

This unit is the device that delivers the low frequency information into the small of your back to give you the "feel" of real explosions, kicks, tackles, sonic booms etc. It operates like a loudspeker in that it has a voice coil and magnet assembly. It has no cone, however. In its place is a heavy steel mass that transmits a jolt by the inertia of the mass. (The mass stays still and the frame moves or sometimes vice versa). We were aware that such devices exist because they are fitted into the seats of some really up market movie theatres. Such electromagnetic actuators are so expensive that they are beyond the budget of most electronics enthusiasts. If you want to experiment with subsonic effects for home cinema etc this is a wonderful opportunity to get some transducers at a reasonable price. Sure you will have to buy the whole unit but they would cost well over $50 on their own anyway!

Specifications for the Subsonic Actuator:
- Operating frequency: Subsonic
- Maximum force: 20 foot pounds
- Rated power: 18 watts continuous RMS
- Dimensions: 250(W) x 300(H)mm
- Nominal force: 0.5 foot pounds per watt
- Voice coil impedance: 4 ohms
- Weight: 1.5kgs

The AURA INTERACTOR was a fairly good seller in the USA but was just too expensive out here at around $269 retail. This made it an accessory that cost more than the games it operated from. Once again Jaycar has made a massive scoop purchase of an entire shipment. The goods are brand new and guaranteed free of defects of any kind for three months after the date of sale.

Our fabulous distress stock buy enables you to secure one of these units for the very modest price of $49.95! we only have a limited number of these so be early!

BUY YOURSELF A PUNCH IN THE KIDNEYS

Supplied with a complete set of leads and adaptors

CONTACT US FOR BULK QUANTITY PRICING!

Cat. XC-1000 **$49.95**

CAR SUB / AMP DEALS

Improve the sound of your car stereo & save big money. Why not add a subwoofer & amplifier?

8" DEAL

CAR AMPLIFIER 4 x 50WRMS. Bridge 2 channels together to give 100WRM to drive the sub and that leaves 50WRMS x 2 to drive your rear speakers. For full specifications on amp. See 1996 cat page 61.
Cat. AA-0435 **$299**

SUBWOOFER Our 8" Re/Sponse Polycone Woofer. Power handling is 120WRMS. For full specs on amp see 1996 cat page 58.
Cat. CS-2234 **$65**

SUBWOOFER CABINET Supplied in knock down form. For full specifications on amp. See 96 cat P54
Cat. CS-2530 **$89**

Total $453

Buy together for $389 Save $64

10" DEAL

CAR AMPLIFIER 4 x 50WRMS. Same as 8" deal.
Cat. AA-0435 **$299**

SUBWOOFER 10" Polycone Re/Sponse. See cat page 58.
Cat. CS-2236 **$99**

SUBWOOFER CABINET Supplied in knock down form. See cat page 54.
Cat. CS-2532 **$99.50**

Total $497.50

Buy together for $429

Save $68.50

ADD $50 IF YOU PREFER THE CARBON FIBRE WOOFER - CAT. CS-2244

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

Jaycar RE/SPONSE 4" SPLIT CAR SPEAKERS WIN THE SOUNDOFF!!!

WARRANTY 1 YEAR

In the new issue of Hot 4's and Performance Cars, they tested 8 pairs of 4" car speakers. Those tested were Clarion $99, Coustic $67.50, Jaycar Re/sponse CS-2280 $99, JBL $99, Linear Series $99, Phoenix Gold $99, Sanyo $89 and Kenwood. The winner (by a huge margin) were our very own Jaycar Re/Sponse CS-2280 speakers.

Comments from Hot 4's on our speakers, "The Jaycars stood out straight away as the only speakers on test that were able to produce a wide and deep soundstage. We honestly didn't think you could get a pair of speakers this good for under $100 a pair and we reckon they could probably take on speakers triple the price. Highly recommended."

For full details and specifications of these (and other Re/Sponse speakers) see our 1997 catalogue. Supplied with: •adjustable super tweeter •grills and hardware •in-line crossover network

Cat. CS-2280 **$49.50 each**

Also available in 5", 6" and 6" x 9" versions

8" PAPER CONE WOOFER

See 1996 Catalogue, page 35 for full details. Power handling 30WRM.

Cat. CW-2111

Was $27.95

June $20

Save $7.95

BARGAIN BAGS

NEW BATCH

We have just finished making our new batch of bargain bags. Full of new goodies and surprises. Mail order customers, please add extra $5 due to massive weight.

Cat. XB-9000

Still Only $14.95

CAR COMPUTER PROTECTOR

New 97

Connect across the car battery while jump starting to protect the cars electronics from spikes. See 1997 catalogue page 60 for full details.

Cat. AA-3098

$17.95

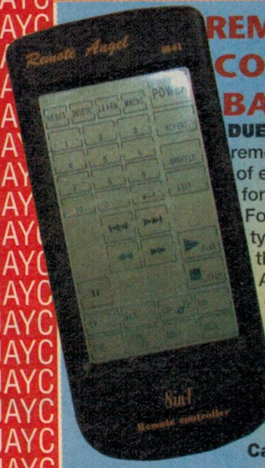
FLEXI-LIGHT AND MIRROR

Flexi-light has a 240mm flexible "gooseneck" which will stay in whatever position you bend it. On the end is a small globe and a mirror. The mirror measures approx. 50 x 25mm and can be adjusted to just about any angle. The globe is powered by 2 x AA batteries (not supplied). Cat. ST-3008

New 97

Only $14.95

REMOTE ANGEL REMOTE CONTROL WITH LCD BACKLIT SCREEN



New 97

DUE TO POPULAR DEMAND - It is a learning remote control and will operate up to 8 pieces of equipment. It has a different LCD display for each piece of equipment its controlling. For example, the VCR mode displays the typical VCR functions and when switched to the TV, the controls appear on the screen. And, if you don't want all the functions on a display, you can simply delete what you don't want. There are 28 programmable visual keys for each individual component. You can teach any command key, any function in each of the 8 devices. An amazing piece of equipment, that is worth the asking price.

Cat. AR-1725

NOW ONLY $189

Also available without backlight

Cat. AR-1720 **Only $159**

JAYCAR INTRODUCES HI FI QUALITY REPLACEMENT SPEAKERS AT BUDGET PRICES

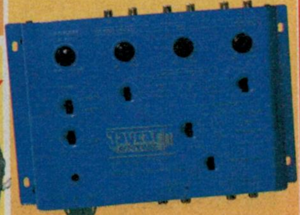
All drivers are 8Ω and have black paper cones with rubber surrounds and big magnets.

New 97

CW-2105

Cat. CW-2105	6"	20 WRMS	$17.95
Cat. CW-2110	8"	30 WRMS	$24.95
Cat. CW-2119	10"	40 WRMS	$29.95
Cat. CW-2125	12"	50 WRMS	$39.95

2 / 3 WAY ELECTRONIC CAR OR VAN CROSSOVER NETWORK



An electronic crossover enables you to divide the frequencies before the power amplifiers. This allows only those frequencies going to certain drivers to be amplified. For specs. refer to 1997 cat. Cat. AA-0460

Was $89.50 Save $20

This Month $69.50

JAYTECH SLIMLINE TELEPHONE

New 97

New for 1997. Brand new phone that utilises the very latest technology.

Features include:

- Desk or wall mounting
- Tone or pulse switchable dialling
- Redial button
- Supplied with a US modular style plug and an adaptor to allow use with the standard type telephone outlet
- Ivory in colour

CONTACT OUR WHOLESALE DEPT FOR BULK PRICES

Cat. YT-7040 **ONLY $23.95**

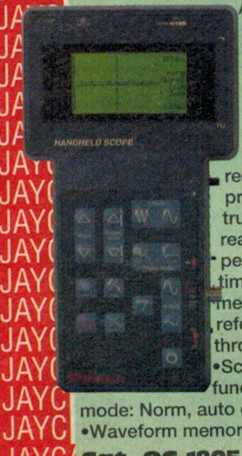
12 VOLT 26 WATT TWIN TUBE FLUORESCENT LIGHT

New 97

This 12V tube light is ideal for boats, caravans, buses, campers, 12V houses, garages etc., etc.. It has two 13 watt fluro tubes. A push button On/Off switch is included. Current draw is a low 1.25A.

Cat. ST-3021 **Only $29.95**

LCD HANDHELD CRO



New 97

At last everybody can afford a portable LCD Oscilloscope! This compact unit features all functions (and more) of an ordinary scope and comes with a high contrast, wide viewing angle display. It has a built-in sinewave generator and it allows instant download of the most recent data to a computer for further processing. It can be used as a DVM with true RMS, peak-to-peak and DC volt readout. **Features:** •True RMS or peak to peak read out •Markers for voltage and time •Auto range function for input measure-ment •DC readout with zero reference function •Frequency readout through markers •Dot join function •Screen hold function •Grid or ruler function •Adjustable trigger level •Trigger mode: Norm, auto or single •Trigger edge: Rising or falling •Waveform memory •RS232 data output to computer

Cat. QC-1905 **Only $449**

32 RANGE DMM

- Holster included
- Large display
- Buzzer
- Diode test.
- Transistor test

Cat. QM-1300

Was $49.95

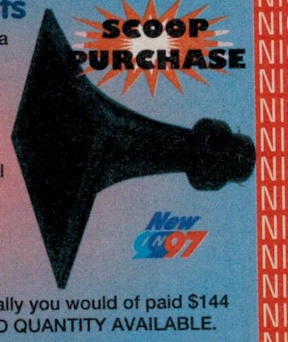
Now $39.95

June Save $10

PA DRIVER AND HORN COMBO

Attention PA enthusiasts

SCOOP PURCHASE



New 97

We have purchased a quantity of Motorola KSN1142 piezo drivers together with the Sammi SH-350 professional horn. If you require audience penetrating projection, together with huge power, well this fantastic combo will compliment any two way speaker bin. •Horn type: exponential •Horn cut off:600Hz •ABS resin •Dispersion: 120x90° •Throat dia: 24mm •318Wx198Hx211Dmm •Piezo power: 400WRMS •Freq resp: 1.8K to 20kHz. Three year warranty on driver.

Last year if you purchased the 2 individually you would of paid $144

Cat. CT-1930 LIMITED QUANTITY AVAILABLE.

ONLY $89 SAVE $55

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

UNIVERSAL SPEAKER BRACKET

New 97

Allow you to mount them on an external or internal building corner. Max. load 15kg each. See 1997 Catalogue page 48 for full details. **Cat. CW-2838**

Was $49.95 Pair Save $10

Now $39.95 pair

SMOKE DETECTORS SAVE LIVES

Battery operated. The Fire Department recommend you install these. At this price, there really is not much excuse **Cat LA-5090**

Only $12.95 or 5 for $60.00

JAYCAR CABLE DEALS

CABLE SPECIALS FOR THE CAR

8GA OFC POWER (6.5mm OD)		4GA OFC POWER (10mm OD)	
Red	Cat. WH-3060	Red	Cat. WH-3064
Black	Cat. WH-3062	Black	Cat. WH-3066
$2.95 mt. per colour		$7.95 mt. per colour	

SPEAKER CABLE SPECIALS

JUMBO SPEAKER
2 x 259 Strands Cat. WH-1732
$3.70 metre

HEAVY DUTY
2 x 79/0.2mm Cat. WH-1712
$2.60 metre

MONITOR OFC
2 x 273 OFC Cat. WH-1735
$4.20 metre

OFC SUPER FLAT
2x7x48/0.10 2mm thick
Cat. WB-1738
$4.95 metre

THE "FULL HOUSE" POWER DRIVER BIT SET

New 97

All the weirdo driver bits in one go!! - The set consists of 32 of the driver bits that you don't normally see. You don't get any slotted, Phillips or Posidrive bits. You do get: •4 x Tri-wing, size 1, 2, 3, and 4 •9 x Torx (tamperproof), size T8, T10, T15, T20, T25, T27, T30 and T35 •4 x Pin drive (snake), size 4, 6, 8 and10 •6 x In - Hex (allen), *metric, size 2, 2.5, 3, 4, 5 and 6 •6 x In - Hex (allen), *imperial size 5/64", 3/32", 7/64", 1/8", 9/64" and 5/32" •3 x Torque Set, size 8, 9 and 10. With this you get a hex driver with magnetic retainer, all in a nifty plasticy - rubber holder that is smaller than a deck of cards! (67 x 45 x 30mm). you will never get stopped by a wacko screw ever again!!

Cat. TD-2035 **$29.95**

AUDIO/VIDEO LEADS

Connect a stereo VCR to a stereo TV or Dolby unit.

3 RCA Plugs to 3 RCA plugs

1.5 metres long
Cat. WA-1080 **$4.95**

3 metres long
Cat. WA-1082 **$6.95**

New 97

3 RCA Piggyback Plugs to 3 RCA Plugs

Ideal if you want to connect your stereo VCR to both your TV and Dolby surround amp. You will need a set of WA-1080 leads also - 1.5 metres long

Cat. WA-1084 **$5.95**

THE LATEST KITS

Description:	Cat. No	Reference	
NTSC - PAL Converter	KC-5223	SC 5/97	$149.50
Spacewriter	KC-5222	SC 5/97	$39.95
Neon tube modulator	KC-5221	SC 5/97	$7.50
Loudspeaker protector	KC-5220	SC 3/97	$19.95
Continuity tester	KC-5219	SC 2/97	$17.95
Smoke detector module	KC-5218	SC 1/97	$5.95
Smoke alarm panel	KC-5217	SC 1/97	$109.00
Interior light delay	KA-1793	EA 4/97	$9.50
ARB waveform / func	KA-1792	EA 3-4/97	$99.00
Critical system alarm	KA-1791	EA 3/97	$16.95

Jaycar ELECTRONICS No 1 For Kits

ALL JAYCAR STORES NOW HAVE EFTPOS!

VIDEO CAMERA LENS SCOOP!!!

We have made a sensational scoop purchase of a limited amount of video camera tele-converter lenses. SAVE A FORTUNE ON NORMAL PRICES!!! These are currently selling at Camera stores at prices up to $179. These lenses are reversible 2-in-1 types, 1.5X telephoto and 0.6X wide angle. ONE YEAR WARRANTY.

0.6X Wide Angle | Normal | 1.5X Tele

2 SIZES AVAILABLE:- This reversible 2-in-1 lens is available to fit both the Sony type micro camcorders and the standard size camcorder. They are lightweight, with specially coated optics to ensure correct colour balance and crisp images. Both come with adaptor rings to make compatible with a range of camcorder brands.

SMALL SIZE: Fits small camcorders, including Sony micro, Hitachi, Sharp and many security cameras. Supplied with 52 - 37mm adaptor ring.

Cat. QL-3420 **WAS $59.95**

LARGE SIZE: Fits most standard size camcorders - Panasonic VHS-C, JVC, Sharp etc. Includes 3 adaptor rings; 58-52mm, 58-49mm, 58-46mm.

Cat. QL-3400 **WAS $59.95**

JUNE $39.95EA - SAVE $20

TURN YOUR SURPLUS STOCK INTO CASH!

Jaycar buys surplus/distress stock of most electronic products from components to built products. If you have marketable quantities of stock you need to clear contact Bruce Routley or Mark Ostro on Phone: 02 9743 5222 Fax: 02 9743 2066

SURROUND SOUND FLOOR STAND

New 97

Ideal for rear speakers in a Dolby Pro Logic System. See 97 Cat page 48 for details.

Cat. CW-2850

Only $49.95 Pair

Playmaster Pro Series IV Preamp Kit

See cat page 3 for full details.

Cat. KA-1790 Only	$229.00
AR-1710 Remote Control	$43.95
Normally	$272.95

Buy Together For $249.00

Save $23.95

BUY 10 LESS 10%

SUBWOOFER AS USED IN NEW ELECTRONICS AUSTRALIA KIT

Refer EA March 1997.

Use your woodwork skills, our CW-2136 woofer and build your own woofer. Power handling 120WRMS.

Cat. CW-2136

Only $69.50

TIE CLIP WIRED/WIRELESS MIC

This mic works extremely well in both FM wireless and wired mode. It consists of a black box (about the size of a packet of 20 cigarettes) which clips on your belt or pants. This box accepts the lead in from the tie clip microphone, holds the batteries and the cable to the amplifier runs from here. For a small mic if offers excellent frequency response & tonal quality. See 1996 cat P146 for full details **Cat. AM-4078**

Was $49.95 Save $12

June $37.95

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

Construction Project:

RHYTHM SEQUENCER USING A BASIC STAMP

Here's an interesting and low cost project which takes advantage of a BASIC Stamp microcontroller module. It's an easily programmable rhythm generator module — virtually an electronic 'jazz drummer'. The author gives plenty of sample programs to get you going...

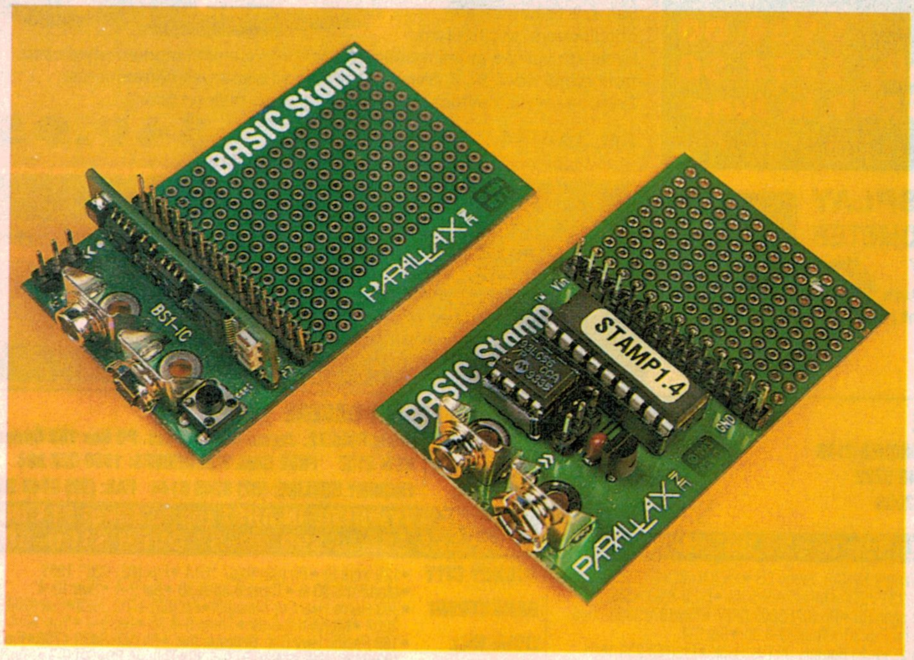
by OWEN BISHOP

Many items of domestic, office and industrial equipment, from CD players to clothes washers and fax machines, are able to perform their complex tasks only because they contain a microcontroller. This is a 'computer-on-a-chip' — not able to provide all the functions of a fully-fledged microcomputer, but clever enough to control some kind of machine.

Among the many microcontrollers available is the BASIC Stamp, which gets its name from being a complete PIC-based computer system on a board measuring only 37 x 11mm, or roughly the size of a postage stamp. Not only is it small but it has low current requirements and can be powered for periods reckoned in weeks from a 9V battery. This makes it ideal for hand-held applications.

As the name suggests, the BASIC Stamp's feature of greatest appeal to the home constructor is that it is programmed in BASIC. Its BASIC includes most of the commands of standard BASICs such as GWBASIC or QUICKBASIC, but also several commands of its own, intended to simplify some of the functions that microcontrollers are often asked to perform.

Programming the BASIC Stamp is extremely simple. When you buy the initial kit, the Stamp comes with a detailed handbook, a 'carrier' circuit board which includes a special area for assembling simple experimental circuits and interfaces, a lead for connecting this to the parallel (printer) port of your PC and a diskette of software for programming the Stamp.



Two of the versions of the BASIC Stamp module currently available. At right is the BASIC Stamp I (Revision D) with conventional DIP-package chips on the main PCB, while at left is the BS1-IC version (Revision E) with surface-mount devices on a small SIL module which plugs into a 'carrier' board. There's also a BS2-IC version, with all parts on a 24-pin IC header, and a 'short form' chip set.

The PC software generates an editing screen into which you type the Stamp program (there are lots of simple ones in the handbook and this article provides several more). All you then have to do is to type 'Alt-R' and the program is downloaded into the Stamp's memory in a few seconds, where it starts to run straight away. After that you can disconnect the Stamp from the PC and you have a stand-alone controlled circuit.

The BASIC Stamp chip retains the program in its memory indefinitely, even when the power is switched off. The program runs automatically as soon as you switch on again, or when you press the 'Reset' button on the carrier board.

Although Stamp remembers a program for virtually as long as you want it, you can also change the program as often as you like. This makes developing Stamp programs so effortless. Any program modification, large or small, is made on the editor screen, downloaded and run in a few seconds. This feature is a boon in projects such as the one described here, where you may want to nudge timings and frequencies this way and that, to obtain exactly the effect you are wanting.

There is a lot more to be said about the BASIC Stamp. But if you want to know more, get details from the Australian suppliers, MicroZed Computers of PO Box 634, Armidale 2350; phone (067) 72 2777, fax (067) 72 8987. You can also access MicroZed's Web page, at **http://www.microzed.com.au/~microzed** or access the Web site of manufacturer Parallax Inc. in the USA, at **http://www.parallaxinc.com/**.

Now to begin. A rhythm sequencer plays a repeated sequence of sounds that

are similar to those produced by percussion instruments. In this project the 'instruments' are under the control of the BASIC Stamp. The Stamp is the 'conductor' of the percussion section of our 'electronic jazz band'.

The sounds of percussion instruments fall into two main groups:

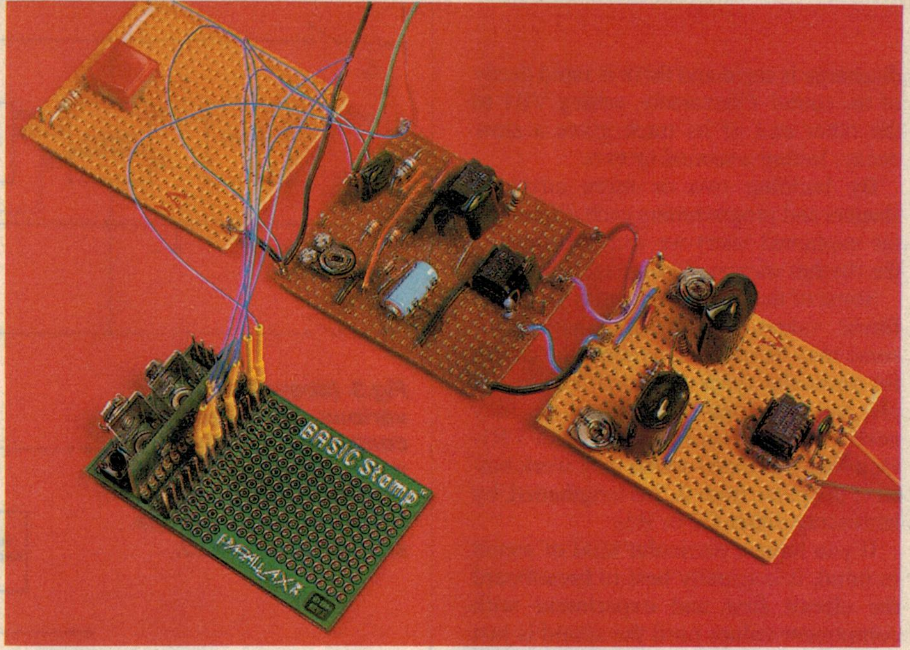
1. White noise: when a cymbal is struck, it produces a random waveform (white noise) which has maximum amplitude at the start and dies away slowly. We say that the envelope of the sound has almost *instant attack*, and *slow decay*. To imitate instruments of this kind electronically we begin with a white noise source, filter its output to emphasise certain frequencies, then pass it through an envelope shaper. With different filtering and decay rates we can form sounds like those of cymbals of various kinds, and other sounds such as a brushed drum.

2. Damped vibrations: when a gong is struck or a string is plucked, it produces a complicated waveform for an instant but the harmonics quickly die out, leaving a sine wave with a relatively slower decay rate. To mimic gongs, bells, drums, maracas and similar instruments, we ignore the initial complex phase and concentrate on the decay phase. Electronically we do this by generating a tone of constant amplitude, then passing it through an envelope shaper. Again we need almost instant attack and slow decay.

Because the BASIC Stamp has its own white noise and tone generator, we do not need to generate the primary sounds electronically. The Stamp SOUND command syntax is:

sound pin (note, duration, note, duration...)

We can use capitals or lower-case for programming, but generally lower case is more convenient. In this statement, 'pin' has a value of 0-7 and is the number of the pin on which the sound signal is to be produced. 'Note' is a number from 0 (silent) to 127 for a musical note, and from 128 to 255 for a range of 'filtered' white noises. 'Duration' specifies the length of the sound, in units of 12ms.



Three of the author's rhythm generator modules, together with a BASIC Stamp module (BS1-IC) at front left. From top left are seen his keyboard module, the envelope shaping module and the mixer module.

Given that the Stamp in effect provides filtered white noise, or can produce a tone with any frequency in the range from 94.8Hz to 10.55kHz, all we need is an envelope shaper (Fig.1). The sound signal comes from pin 0 of the Stamp and goes to a CA3080 transconductance amplifier. This has a control pin (pin 5) and, by applying a control voltage here, we can vary the amplitude of the output from zero to a maximum.

We can't use the Stamp to control the envelope shaper directly, because only one operation may be controlled at a time. Instead, we send a short pulse to trigger the envelope generator, following this immediately by a burst of sound. More precisely, a pulse from Stamp's pin 1, produced using the PULSOUT command, is inverted by MOSFET Q1 and used to trigger a 7555 pulse generator (IC2) into action. The pulse from IC2 charges C3 through D1 almost instantly, so the control voltage rises sharply and the sound has instant attack. The sound is heard at maximum volume.

If the pulse continues after the capacitor is fully charged, we have a period of sustained sound. After the pulse from IC2 ceases, charge leaks away through D2 and VR1. If VR1 is set to a small value,

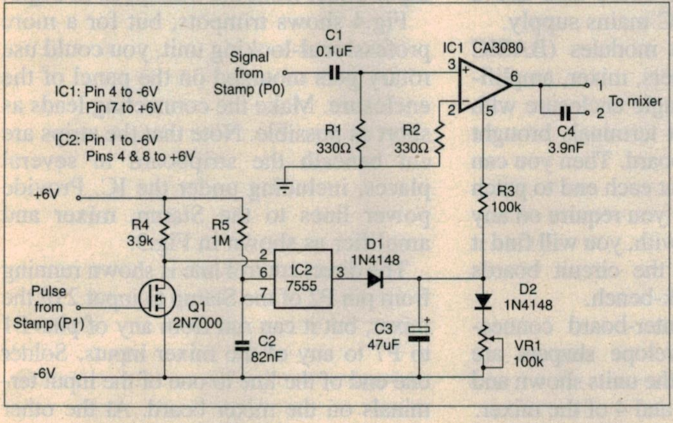


Fig.1: The circuit for the envelope shaping module. Timer chip IC2, triggered by the BASIC Stamp, supplies the envelope waveform to control IC1.

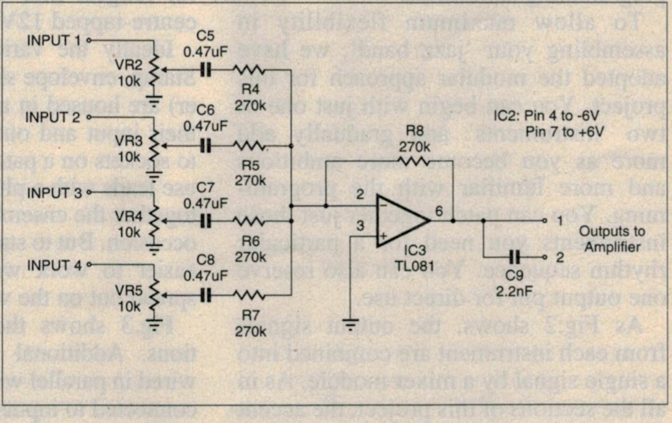


Fig.2: The four-channel mixer module uses a simple summing circuit around op-amp IC3. Each input can accept either a direct input from the Stamp, or via an envelope shaper.

discharge is rapid and there is rapid decay of the sound. Conversely, setting VR1 to the other end of its track gives a slow decay, lasting a second or two.

By building two or more envelope shapers and programming each differently (as explained later) we can put together the rhythm section of our jazz combo.

Some of the components may have different values in different shapers, or some may be omitted, to adapt the circuit for particular types of sound. For example, for very long decay times we may need a 1MΩ resistor in series with VR1. Or a long-sustained sound may work better if the pulse from IC2 is lengthened, by increasing either C2 or R5.

If you have a particular kind of sound in mind, it is usually best to breadboard the circuit first and experiment with component values until the sound is just right. But do not alter R3, for this could result in the destruction of the IC.

You need a separate board for each sound effect that is to be included in a sequence and, since the Stamp has eight output pins, you can 'play' sequences consisting of up to four percussive instruments (two pins per instrument/shaper, one for the sound and one for its pulse).

Of course, one board may be used for more than one instrument, if you wish. Between sessions, it is 're-tuned' by adjusting VR1 to suit it to a different sequence.

Certain percussive sounds can be made directly, without needing an envelope shaper. These are sounds such as a muted cymbal or wooden blocks, which have instant attack and decay. These directly generated sounds take up only one of the Stamp's output pins, since different sounds are generated in succession from the same pin simply by writing a series of programming commands.

To allow maximum flexibility in assembling your 'jazz band', we have adopted the modular approach for this project. You can begin with just one or two 'instruments' and gradually add more as you become more ambitious and more familiar with the programming. You can patch together just those instruments you need for a particular rhythm sequence. You can also reserve one output pin for direct use.

As Fig.2 shows, the output signals from each instrument are combined into a single signal by a mixer module. As in all the sections of this project, the accent is on simplicity so here we have just an operational amplifier wired as a voltage summer. The variable resistors are used

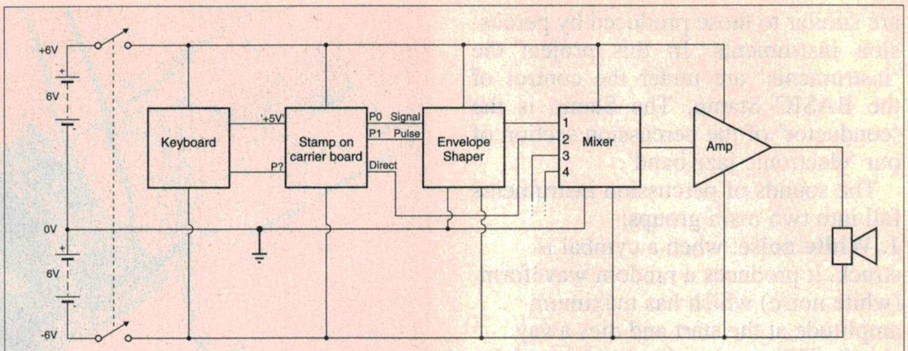


Fig.3 (above): How the various modules are connected together to make up the finished rhythm sequencer. More than one envelope shaper can be used.

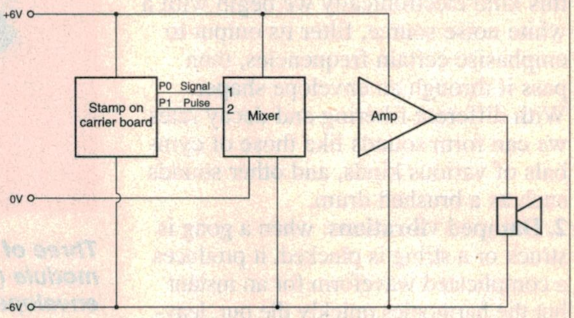


Fig.5 (right): Use these module connections to test the mixer module.

to set the relative volumes of the component signals.

The system needs an audio amplifier. You may already have an amplifier and speaker that you can use. If not, the cheapest solution is to build one from a kit.

Although an un-enclosed speaker can be used when testing, you will not get the true sound or the full volume unless the speaker is mounted in a proper enclosure. We used a speaker 'borrowed' from a spare stereo system.

Construction

The system requires a dual 6V DC supply, which can come from two 6V batteries of dry cells. Use D-type cells for longest life. You could also use a centre-tapped 12V DC mains supply.

Ideally the various modules (BASIC Stamp, envelope shapers, mixer, amplifier) are housed in a single enclosure with their input and output terminals brought to sockets on a patchboard. Then you can use leads with a plug at each end to patch together the ensemble you require on any occasion. But to start with, you will find it easier to work with the circuit boards spread out on the work-bench.

Fig.3 shows the inter-board connections. Additional envelope shapers are wired in parallel with the units shown and connected to inputs 3 and 4 of the mixer.

The power supply to the Stamp is best wired to a PP3 battery clip which is clipped on to the two battery terminals of the carrier board. Take care to get the polarity right. Here we are using the clip as a source of power, so the plug-like (male) terminal is to be negative (as it is on a battery). If the clip is already provided with red and black wires, this terminal is already connected to the red wire, which must be connected to the negative line of the power supply.

Begin by acquiring or building the amplifier. Next assemble the mixer module (Fig.4). To begin with, you may not want to use four instruments at once, so you can omit VR4, VR5, C7, C8, R6 and R7, to mix just two instruments. This would suit a pair of envelope shapers or one envelope shaper and one input direct from the Stamp, as in Fig.3.

Fig.4 shows trimpots, but for a more professional-looking unit, you could use rotary pots mounted on the panel of the enclosure. Make the connecting leads as short as possible. Note that the strips are cut beneath the stripboard in several places, including under the IC. Provide power lines to the Stamp, mixer and amplifier as shown in Fig.3.

The direct control line is shown running from pin P2 of the Stamp to input 2 of the mixer, but it can run from any of pins P1 to P7 to any of the mixer inputs. Solder one end of the line to one of the input terminals on the mixer board. At the other end you can solder it direct to the carrier board (remove the Stamp while you do this) or (more conveniently) make up a

socket to fit on to the 14-pin single-in-line plug on the carrier board (cut a 40-pin header socket down to 14 pins).

Connect the mixer to the amplifier by either one of its outputs. Connection by way of C9 gives more 'edge' to the sound, and usually allows the amplifier volume control to operate over a greater range. Fig.5 shows the connections required for the mixer test, which differ from Fig.3 in having two direct connections. A suitable program is:

'Mixer test
begin:
sound 0, (100, 10)
pause 200
sound 1, (150,10)
pause 200
goto begin

To clarify a few programming points, note that the apostrophe (') is used to begin a remark or comment line (like REM in BASIC). On the next line 'begin:' (ending in a colon the first time it is used) is a label, marking a point in a program (no line numbers in this version of BASIC). 'Sound' is dealt with above, while 'pause' halts the program for a time expressed in milliseconds.

So this program produces alternately a 120ms burst of white noise from pin 0 and a 120ms musical tone from pin 1, with 200ms gaps between sounds. At the end of the program, 'goto begin' sends the Stamp back to 'begin:' to repeat the loop. The program runs until we download a new program or switch off the Stamp's power supply.

Run the program and then vary VR2 and VR3 of the mixer to hear one sound or the other, or both, through the speaker.

While you have this test circuit set up, you may like to play around with similar programs to hear the effects of different values used as SOUND parameters. You can also try your first rhythm sequence, using just direct sound effects:

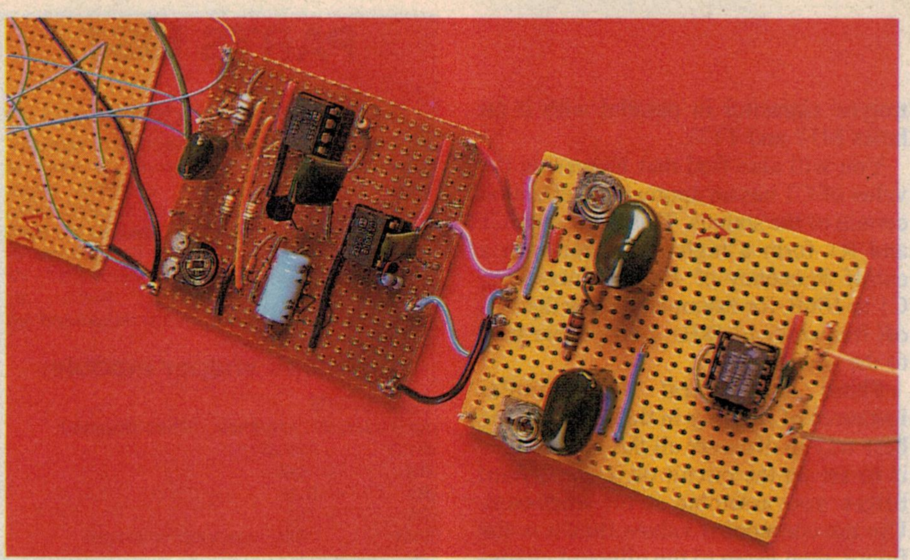
'Waltz
begin:
sound 0, (251,7)
pause 400
sound 0, (130,7)
pause 400
sound 0, (130,7)
pause 400
goto begin

In this case all sound comes from pin 0. Then, with pins 0 and 1 connected to Inputs 1 and 2 of the mixer, you can adjust VR2 and VR3 to accentuate the first beat and obtain a better waltz tempo. Here is the cha-cha-cha:

'Cha-cha-cha
for b0 = 1 to 10
sound 0, (35,25,0,20,35,25,0,20,245,6,0,20,245,6,0,20,245,6,0,40)
next

In this program we use a 'for...next' loop to play the rhythm for 10 bars, then the program ends. Start it again by pressing the 'Reset' button on the carrier board.

We have allocated one of the BASIC Stamp's memory bytes (b0) to act as storage for the loop counter. To save memory we have used one **sound** statement to produce a sequence of sounds. This includes sound 0 as the note value, instead of using the 'pause' command.



A closer view of the author's envelope shaping module (upper left) and mixer module (lower right). Only two inputs are wired on this particular mixer module.

Envelopes

Fig.6 is the layout for a envelope shaper suited to cymbal and similar effects that have instant attack and slow decay.

The strips are cut beneath the board at B10 to E10, H17 to K17, H15 and R6. You may decide to increase the value of C3 to obtain longer decay periods, perhaps by wiring a 10uF or 22uF elec-

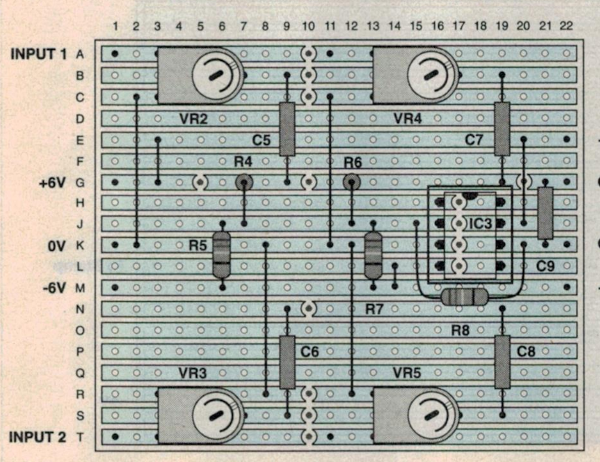
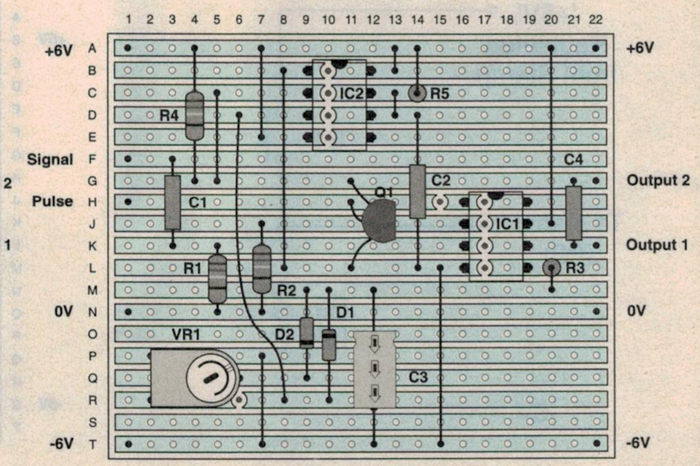


Fig.4: The stripboard layout for the mixer module...



...and envelope shaper (Fig.6)

trolytic capacitor in parallel with it (at holes M17 and T17).

You will also find that increasing the value of C1 has an appreciable effect on certain of the sounds. This is because C1 and R1 form a high-pass filter with a cutoff frequency of 4.8kHz. Increasing C1 to 10uF, for example, lowers the cut-off frequency to 48Hz giving more bass to the sounds.

There are several other similar instances of filtering in this project. The best way to discover all the possibilities is to set up the circuit on a breadboard before you assemble it on stripboard. Use the component values shown in the figure, then listen to the effect of changing one or more values.

To check the action of IC1, connect the shaper to the Basic Stamp and the mixer as in Fig 3, but temporarily connect the junction of D1/C3/D2/R3 to +6V. This turns the amplifier fully on. When you run the program below, you hear the bursts of white noise with instant attack and decay (that is, no envelope):

```
'Cymbals (large)
low 1
for bo = 1 to 5
pulsout 1, 5
sound 0, (200, 40)
pause 1000
next
```

This program begins by setting the output of pin 1 to zero (-6V) so that pin 2 of IC2 is held high (+6V). In each cycle of the loop there is a triggering pulse lasting 0.09 seconds from pin 1, immediately followed by a 0.5s burst of white noise from pin 0. The loop repeats after one second until there have been five clashes of the cymbals altogether. You can check the action of IC2 by monitoring the voltage at pin 3; this goes high for about 90ms every 1.6s.

Remove the temporary connection to +6V and re-run the program. The voltage across C3 rises sharply every 0.6s and falls more slowly, at a rate dependant on the setting of VR1. If VR1 is set high, the voltage will not have fallen to -6V before it is pulsed up again. If you want to give it more time to fall, extend the length of the sound from '40' to, say, 100. Try the effect of varying the setting of VR1.

PARTS LIST

Stamp module:

BASIC Stamp BS1, on carrier board, with programming cable and software. Or use the lower-cost COUNTERFEIT, a slightly larger Stamp lookalike, still based on the PIC micro but assembled from a Scott Edwards kit. Both are available from MicroZed Computers, of PO Box 634, Armidale 2350; phone (067) 72 2777, fax (067) 72 8987 or **http://www.microzed.com.au/~microzed on the Web.**

Envelope shaper module:

Resistors

All 0.25W, 5% tolerance, unless indicated:

R1,2	330 ohms
R3	100k
R4	3.9k
R5	1M
VR1	100k, rotary pot or trimpot

Capacitors

All metallised polyester (Greencaps) unless otherwise specified:

C1	0.1uF
C2	82nF
C3	47uF or 100uF, electrolytic
C4	3.9nF

Semiconductors

D1,2	1N4148 diodes
Q1	2N7000, N-channel enhancement MOSFET
IC1	CA3080 operational transconductance amp
IC2	7555 CMOS timer

Miscellaneous

Piece of stripboard 50 x 57mm (19 strips x 22 holes); 1mm terminal pins (9 off); DIL 8-pin IC sockets (2 off).

Mixer module:

Resistors

R4-8	270k 0.25W, 5% (5 off)
VR2-5	10k rotary pot or trimpot (4 off)

Capacitors

All metallised polyester:

C5-8	0.47uF (4 off)
C9	2.2nF

Miscellaneous

Piece of stripboard 50 x 57mm (19 strips x 22 holes); 1mm terminal pins (9 off); DIL 8-pin IC socket.

Keyboard module:

R9	10k resistor (0.25W, 5%)
S1	Pushbutton switch, PCB mounting

Piece of stripboard 50 x 57mm (19 strips x 22 holes); 1mm terminal pins (4 off).

Sequencing

Now comes the fun! With one or two envelope shapers and some direct sounds, you are all set to invent dozens of rhythmic sequences. They are limited only by your imagination. Remember that you are not restricted to imitating the conventional percussion instruments. Any sound signal that the Stamp produces is a candidate for a sequence.

The key variables are the frequency and duration, expressed as two values (we will call them f and d) in the 'sound' command: 'sound n, (f1, d1, f2, d2, ...)'. There is also the setting of the decay rate.

To a certain extent the setting of the variable resistor in the mixer also has an

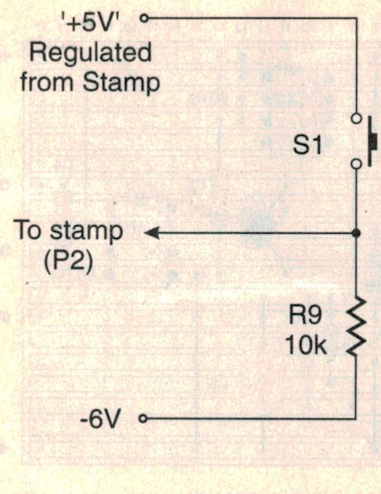


Fig.7: The simple circuit used for the 'keyboard' module.

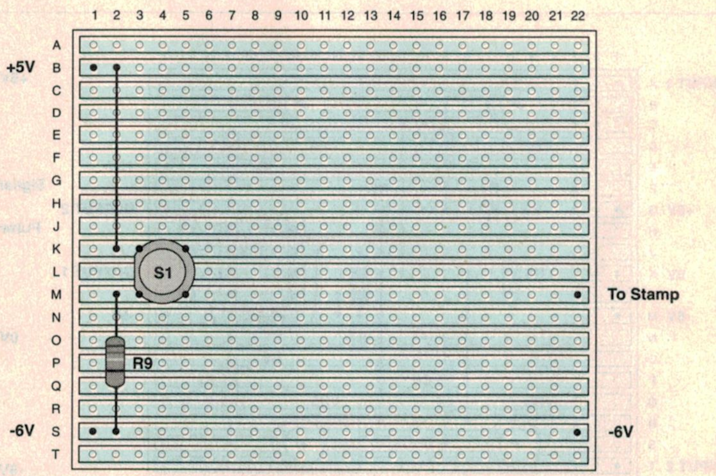


Fig.8: The stripboard layout for the keyboard module.

For those wanting to get into using the BASIC Stamp for their own applications, Microzed can supply programming kits including a manual, software for the PC, connecting cables and of course the various BASIC Stamp modules and carrier boards.

effect, since reduced volume cuts off the end of the decay. Normally, work with these resistors set half-way and adjust the amplifier resistor to get the volume you want.

If f is in the range 1 to 50 and d in the range 1 to 20, you obtain drum-like sounds, particularly with small values for d. At the other end of the tone range, (127,1) gives a good beat sound, while (126,1) has a strange combination of beat and a high-pitched 'ding' which sounds rather like a tambourine.

If f is 125 or a little less and d is 1, we obtain 'wood-block' sounds, similar to a xylophone.

Turning to noise-based sounds, (128,3) gives another useful 'beat' sound like a side-drum, while higher values of f give cymbal-like sounds. For example (255,3) sounds like a brushed cymbal.

The envelope shaper adds another parameter to the sound — the decay rate. To exploit this, the duration of the sound should normally equal or exceed the length of the decay period. With VR1 set for long decay, try this program:

'tolling bell
low 1
begin:
pulsout 1, 5000
sound 0, (1,255, 0, 255)
goto begin

Try varying f from 1 to 50. If the sound cuts off abruptly, even when VR1 is set to its maximum (fully clockwise), try replacing C3 with a capacitor of larger value or temporarily wire another large-value capacitor in parallel with C3.

The lower-value noise bursts mostly sound like distant explosions, so perhaps are not much use here. Values for f in the region of 150 give a bass drum effect. Here is a military-band sound:

'Bass drum
low 1
begin:
pulsout 1,50
sound 0, (155,50,0,20)
pulsout 1,50
sound 0,(155,50,0,20)
pulsout 1,50
sound 0, (155, 255, 0, 25)
goto begin

Note the lengthened, final 'booooom'. Among the higher frequencies, f between 251 and 252 gives a gong-like sound, while 253 to 255 produce cymbals.

Timing

Sounds should normally be played with silent 'rests' between them. If you use 'pause' for silence, remember that this works in units of milliseconds. Sounds are timed in units of 12ms and so a silent 'sound 1, (0,10)' is equivalent to a 'pause' of 120ms.

For overall timing, or tempo, take a quaver as 40 (in 'sound' statements) and a semi-quaver as 20. As an example, a samba is played in 2/4 time, that is eight semi-quavers to the bar. It has a small drum on beats 1, 4, 5, 6, and 8, but we shall have to leave this out as we can not play two sounds at one time. Use just a large (low pitch) drum on beats 1 and 5, with a hi-hat on 1, 3, 4, 5, and 7. Nothing (silence) on beats 2 and 6. The complete program is:

begin:
sound 0, (1,1,0,40,121,1,0,20,121,1,0, 20,1,1,0,40,121,1,0,40)
goto begin

The drum is (1,1) and the hi-hat is 121,1. Gaps between notes are either (0,20) when the notes follow one another, or (0,40) when there is one beat's rest.

To play it more slowly, change silent timings to 40 and 80, which yields the bossa nova.

Rock has eight quavers to the bar, with the cymbal on beats 1,2,4,5,6,8 and the drum on 3 and 7:

begin:
sound 0, (5,1,0,40,121,1,0,40,121,1,0,40, 5,1,0,40,121,1,0,40,121,1,0,40,5,1,0, 40)
goto begin

Sequence control

It can quickly become boring, hearing the same sequence played over and over again. This is why the 'keyboard' module (Fig.7) is a valuable addition to the system. With this you can tell the Stamp to change its tune. It is easily constructed (Fig.8) and the board has room for several keys, though one key is all you need to start with.

This module is powered from the '+5V' line from the BASIC Stamp's built-in regulator. This avoids the risk of applying unduly high voltages to the Stamp. Actually, since the Vss line of the Stamp is connected to the -6V of the supply in this project, the regulator output is actually at -1V with respect to our 0V line, but we refer to it as '+5V', as in the handbook, to avoid confusion.

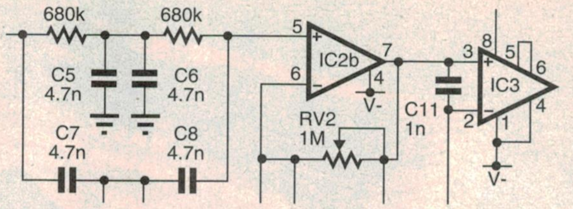
Here is a program to use the keyboard (connected to Stamp's pin 2) to change from one rhythm to another and back again, every time the key is pressed:

'changing tune
wait:
if pin2 = 0 then wait
begin1:
sound (insert sound1 parameters)
if pin2 = 0 then begin1
begin2:
sound (insert sound2 parameters)
if pin2 = 0 then begin2
goto begin1

Insert any sound parameters taken from earlier programs or make some up yourself. The program starts with a waiting routine, so the rhythm does not begin until the key is pressed for the first time.

This program is only one example of the numerous ways in which a single key can be used. More keys on the board allows even wider range of control.

I hope you enjoy experimenting with this educational project based on the BASIC Stamp. ❖

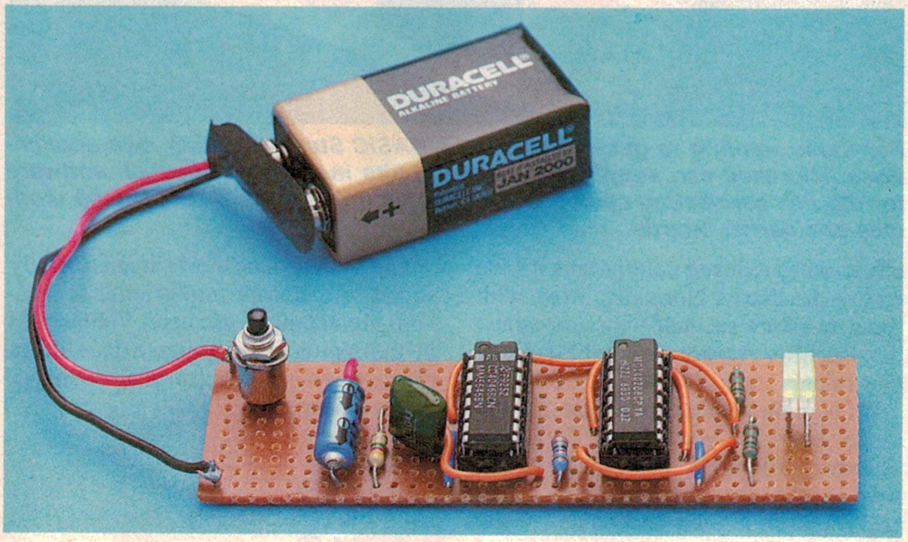


$10 Wonders

by OWEN BISHOP

3 - Electronic Two-Up

Here is a novel version of that famous and ever-popular Aussie game of Two-Up. Not only has this version the excitement of Two-Up itself, but there is also a touch of the nail-biting suspense of the Money Wheel thrown in for good measure.



Two-up is based on the random tossing of two coins, either of which can fall showing heads or tails. In Two-Up terminology, 'Heads' means that both coins fall heads up and 'Tails' means that both coins falls tails up. One head and one tail is known as 'Odds'. Something that we don't have in the electronic version is the 'Floater' in which one or both of the coins do not spin properly. If you have built the circuit correctly, we can guarantee that both coins will spin madly each time!

The reason it is easy to produce an electronic version of Two-Up is that the four binary numbers from 0 to 3 have the same pattern as the four different ways the coins may fall — see Table 1.

Each of the four rows in the table is equally likely to occur when we spin the coins or when we repeatedly count from 0 to 3 in binary and stop at random. So we need a binary counting circuit, and this is shown in the schematic.

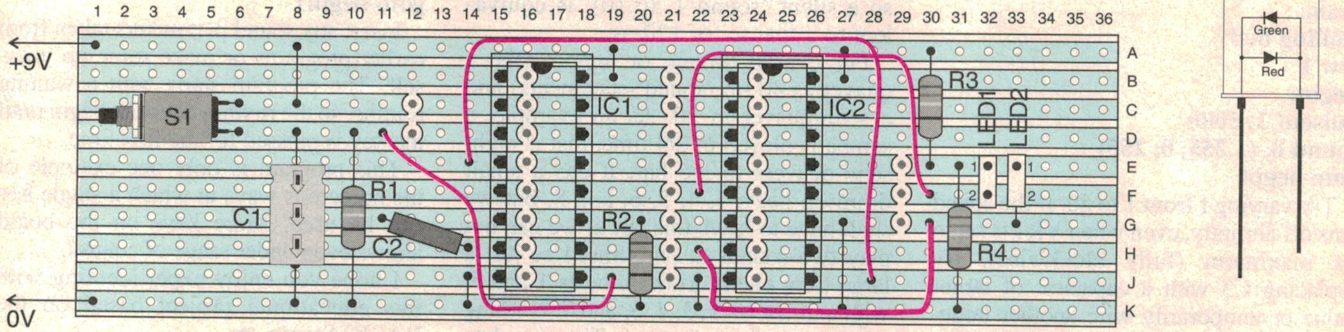
The circuit

The counter (IC2) is driven by a voltage controlled oscillator (VCO) which is contained in IC1. The 4046 is listed in the catalogs as a phase-locked loop. We do not have space here to go into the intricacies of PLLs and there is no need to do so, because here we're using only one part of the circuitry that the 4046 contains.

The part that we are using is the VCO, and the designers of this chip were thoughtful enough to provide access to all the inputs and outputs of the VCO, so we can use this part of the IC without having to worry about the rest of the chip. Pressing S1, the 'Spin' button, instantly charges C1 up to 9V. The top of C1 is connected to the VCO's control input (pin 9), and thus the IC starts oscillating at its maximum rate. The actual frequency of oscillation depends on the values of the timing resistor R2 and the timing capacitor C2, and in this case is 600Hz. (If you want to experiment with this circuit, it might be helpful to know that the formula for deriving the oscillator's frequency is 2/R2C2 when the control input is at +9 volts.)

As soon as the button is released, C1 begins to discharge through R1 and the voltage at the control input (pin 9) starts to fall. It falls rapidly at first, but the further it has fallen the more slowly it falls. Its rate of fall is exponential. In theory, it

Below: As you can see, you will need to install four insulated wire links. Right: This is the type of LED to use in this project; both a red and a green LED are connected back to back in the one two-leaded package.



goes on falling forever, but in practice it is near enough to fully discharged in about a minute. The effect of this is that the oscillator runs quickly at first, gradually slowing down and with the final few oscillations taking several seconds each.

Binary counter

The counter IC is a 4020 fourteen-stage binary counter, but we use only the first five of the stages. This is because there are no outputs from stages 2 and 3, so we use stages 4 (pin 7) and 5 (pin 5) to provide two consecutive outputs.

When the oscillator is operating, the outputs from these two stages run through the four counts from zero to three repeatedly. The rate of oscillation is divided by two at each stage in the counter, so the stage four output oscillates at about 38Hz, and stage five at about 19Hz. The outputs flash the LEDs at these rates and cycle them through the counts 0 to 3, 19 times a second. This is too fast for the individual counts to be detected, but we can identify them as the counting rate falls.

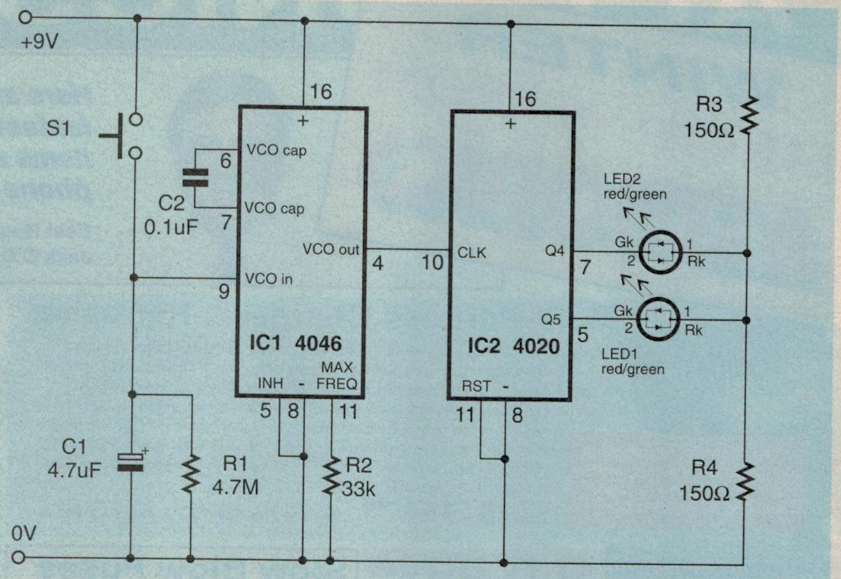
The LEDs used in this project are special two-colour types which are red or green, depending on the direction of current flow (see diagram). One terminal of each LED is connected to the junction of R3 and R4, which is at 4.5V.

When the output from pin 5 or 7 is logical low (0V), current flows through the LED from terminal 2 to terminal 1 and the green LED lights. When the output from pin 5 or 7 is high (9V), current flows the other way and the LED glows red. Thus, as the outputs go through their binary cycle of 0's and 1's, the LEDs go through a cycle of greens and reds. If we take green to mean 'tail' and red to mean 'head', we can use the colours to represent the four possible results of a Two-Up spin.

That's all the theory, but the action is much more exciting. When the button is first released the LEDs change from red to green so fast that they appear to be shining steadily with a yellow colour. The shimmer of gold! Soon we can distinguish alternating red and green. They run through the sequence of 'Tails, Odds, Heads, Odds' more and more slowly. Like the Money Wheel, the last few changes seem to take an interminable time! Where will it stop?

Construction

The circuit fits neatly on to a narrow rectangle of stripboard with the Spin button at one end and the LEDs at the other. The LEDs we used are rectangular, so we mounted them close together in adjacent holes.



This circuit makes use of the voltage controlled oscillator contained inside the phase locked loop chip. It clocks IC2, a binary counter, which in turn lights one or both of the bipolar LEDs on its outputs.

Before mounting any components, cut the copper strips at the places marked on the overlay, which are C12, D12, B16 to J16, B21 to J21, B24 to J24, and E29 to G29. After you have soldered in the sockets, solder in the six tinned copper wire links, followed by the resistors, capacitors, LEDs and the switch. Watch the orientation of the electrolytic capacitor C1, and once all the parts have been installed, you can solder in the four long jumpers onto the board, using appropriate lengths of insulated wire.

There are no particular difficulties in construction and with any luck the circuit should work the first time. As a precaution against static charges, however, keep the two ICs in the conductive foam in which they were purchased until construction is finished and you are ready to insert them in their sockets.

As usual, 'dressing up' the project is left to the reader. You can make this into a pocket-sized game in a compact plastic case, or you can expand it to a party-sized extravaganza with a giant spin button, jumbo LEDs and a few other flashing LEDs and buzzers besides.

Separate red and green LEDs wired anode to cathode can be used instead of the two-colour variety. If you really want to go that far, this circuit could be made to switch relays to control banks of coloured lamps.

TABLE 1

Fall of coins		Binary count
T T	(Tails)	0 0
T H	(Odds)	0 1
H T	(Odds)	1 0
H H	(Heads)	1 1

PARTS LIST

Resistors

All 5% 1/4 Watt

R1	4.7M
R2	33k
R3, R4	150 ohms

Capacitors

C1	4.7uF electrolytic
C2	0.1uF MKT or greencap

Semiconductors

LED1, LED2	red/green light-emitting diodes (the type with two pins, not three)
IC1	4046 CMOS phase locked loop
IC2	4020 CMOS 14-stage binary counter/divider

Miscellaneous

Miniature N.O. pushbutton, PCB mounting preferred 2.5mm matrix stripboard 95mm x 27mm (36 holes x 10 strips); 1mm terminal pins (2 off); battery clip or 4-cell (6V) battery holder, 2 x 16-pin d.i.l. IC sockets.

Playing the game

The game is organized by a Ringkeeper, who holds the bank and chooses a person to become the Spinner. The Spinner operates the circuit, representing the Kip. Everyone places their stake of counters, matches or whatever on the table. The aim of the Spinner is to spin Heads three times before spinning Tails or five consecutive Odds. If successful, they win 7-1/2 to 1. If unsuccessful, another person is chosen as Spinner.

Other players just bet Heads or Tails at each spin and are paid Evens if they win, otherwise losing their stake. Bets must be left unchanged on the table if the spin results in Odds. If there are five consecutive Odds, all players lose their stakes. ❖

ALTRONICS COMPONENTS

WINTER BARGAINS FROM ALTRONICS

Here are some excellent products and fantastic discounts for the winter. As some items always sell out quickly, I suggest you phone now to reserve your order!

Best Regards,
Jack O'Donnell, Managing Director

Jack O'Donnell

Fax Order Line:

Multi-Purpose Charger & Refresher

Charges or discharges Nickel Cadmium and Nickel Metal-Hydride cells, and refreshes up to four carbon or alkaline cells, or up to two 3V lithium cells. Accepts AA and AAA sizes of all capacities. Features LED charging status and cell type indicators. Discharger operates at the push of a button, and if used to "cycle" batteries regularly, it can reduce memory effects in rechargeable cells, giving longer service life. It can even restore the capacity of cells with severe memory by repeated cycling. Powered by 12V DC, either from M 9664 plug pack (not included) or car battery.

Keep your rechargeables in top condition and extend their service life! Also Includes Alkaline Refresh Function.

A 0280 **$39.95**

M 9106 12V 500mA Plug Pack $22.95

13.8V DC 5A Power Supply

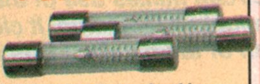
This rugged supply delivers a *regulated* 13.8V DC at up to 5A intermittent, or 3A continuous.

Fully regulated 13.8V output! Ideal for CB's, tape recorders portable TV's etc

M 8250 Normally $110,
NOW Only **$99**

Slow Blow Fuses

SCOOP PURCHASE!



We have a *STRICTLY LIMITED* quantity of hard-to-find M205 and 3AG size slow blow fuses. Slow blows are ideal for applications which draw instantaneous currents which would normally trip a fast blow fuse.

Normally $1.50 each, SAVE 66%!

S 5857 M205 **25A** Pk 10
S 5855 M205 **250mA** Pk 10
S 5859 3AG **250mA** Pk 10
S 5861 3AG **500mA** Pk 10
S 5891 3AG **7.5A** Pk 10
S 5896 3AG **10A** Pk 10

ALL **$5** per pack of 10

"Easy Start" Jump Starter

"...we like the concept because it eliminates jumper cables. Jumper cables are potentially damaging to any car with an engine management computer and most car makers warn against their use."
Product Showcase, Silicon Chip Magazine, April '97

Grab one for Mum! Safe, clean and easy to use . Includes full instructions!

The A 0295 Jump Starter allows you to jump start a car with a flat battery by recharging it via the cigarette lighter socket. One end is plugged into the "good" car's lighter socket, whilst the other goes into the "flat" car's lighter socket. The "good" car is then started and run for about 5 mins, after which the "flat" car should start. The unit has three charge indicator LEDs which show when the bad car is ready for a start attempt. It's clean, easy to use and doesn't require any mechanical knowledge at all! Fits in the glovebox or under a seat, and instructions are included.

A 0295 **$39.95**

Safe for EFI equipped cars!

1500W Switchmode 12V / 240V Inverter

Massive 1500 Watts Output!
Ideal for Remote Home Power Systems. Will Power a wide range of appliances, including Fluoro Lights & Microwaves.

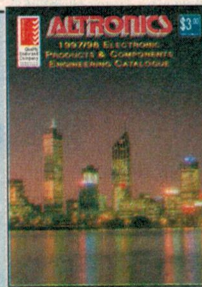
This inverter provides up to a massive *1500W* of 240V power from a heavy duty 12VDC car or truck battery. Switchmode circuitry eliminates bulky and heavy output transformers, making this unit very lightweight compared to similar inverters. It's suitable for a wide range of applications such as remote homes, sail and power boats, building or mine sites, off road vehicles, caravans, farms etc.

Features: • Over temperature & overload shutdown • Auto fan cooling • Low battery warning & shutdown • Heavy duty leads • Twin outlets • Weighs only 3.6kgs

M 8140 Normally $995,
Introductory Price ONLY
$795

SUPER SPECIAL! SAVE a HUGE $200!

Our BEST Catalogue EVER!



The ALTRONICS 1997/98 Electronic Engineering Catalogue is OUT NOW!

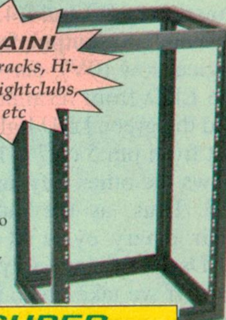
If you don't have yours yet,call

1-800 999 007

for your ***free*** copy!

• **212 pages** • **Dozens of exciting new products**
• **Expanded product data and specifications**

Rack Frame Super Special!



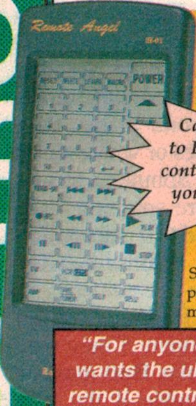
Due to a slight slip-up by our metalwork supplier, these racks have incorrect side panel mounting holes. ***But*** since 80% of our customers don't use side panels on their racks frames, this could be the ***bargain of the year!*** For those who wish to use a panel set on these racks, they can be fitted with only a few minutes work with a drill and file, ***still a massive saving!*** We have *STRICTLY LIMITED* stocks of these rack frames, so *BE QUICK!*

BARGAIN! Ideal for PA racks, Hi-Fi systems, nightclubs, bands, etc

SUPER SPECIAL!

HA5509 9 Unit Rack, Normally $159, NOW **$89**
HA5512 12 Unit Rack, Normally $169, NOW **$99**

Learning Infra-Red Remote Control with *LCD Backlit Screen*



Can replace up to EIGHT remote controls. Eliminate your coffee table clutter!

Are you sick of having remote controls all over the coffee table? Always picking up the wrong one? This ***learning*** remote control can replace up to eight remotes! It features a multi-function ***touch sensitive backlit LCD*** screen. With 8 different appliance modes, it can control a TV, VCR, CD, LD, AMP, TAPE/TUNER, and has auxiliary modes SEL1 and SEL2, which can be custom configured. When you select a mode, the unit changes the buttons on the display to mirror the controls of the selected device. AMP mode includes Surround Sound effects adjustment button (centre, rear, surround etc). The unit is programmed from an original remote, which must be in working order, and a macro function allows one button to perform up to ten sequential tasks. Also features backlighting (unlike others on the market) which is essential at night or when the curtains are drawn. The backlighting is light sensitive, so it only activates in rooms with low light levels, saving batteries. Requires 4 x AAA batteries (supplied).

"For anyone who wants the ultimate remote control, this has to be the one."
Product Showcase, Silicon Chip Magazine May '97

A 1000 Normally $199 ***June SPECIAL only*** **$179**

• *Attention Boating Enthusiasts!* •

2 Way Coaxial Marine Speaker System

Sturdy PVC frame construction and Aluminium Grill. Excellent outdoor speaker system!

Fantastic for boating enthusiasts with an ear for fine music, our Opus One Marine series coaxial system is also the answer for outdoor installations normally subject to high weather corrosion. • Sturdy PVC frame • Polypropylene cone • Powdercoated white aluminium grill • The silky smooth polymide tweeter is swivel mounted enabling high frequency focussing • Easy to install with integral swivel clamps • Massive 80W max power handling

Excellent sound reproduction - definitely amongst the finest weather resistant speakers we have tested.

C 0872 Normally $169 a pair,
NOW ONLY **$129** Per Pair

Features "eyeball" tweeter mount for optimum sound field adjustment!

ALTRONICS

1-800 999 007 **PERTH (09) 328 1599**

DocGL679

Experimenting with Electronics

by DARREN YATES, B.Sc.

4017 CMOS Decade Counters

This month, we continue our look at CMOS ICs with the 4017 decade counter. We show you how to use it, as well as give you some unusual example circuits to play with and test your mathematical skills.

The last time we looked at CMOS circuits, you may recall, we covered the 4015 shift register. This handy little IC contains two four-bit shift registers which you can gang together to obtain a single eight-bit register. The 4017 decade counter is a little similar to this, but easier to use.

The 4017 has 10 outputs, which go high in turn with each successive rising edge on the clock input. We actually looked at a simple musical doorbell circuit last time while covering noisemakers. In that circuit, each output was used to control the frequency of an oscillator to produce different notes.

The 4017 is actually a very versatile chip in that it also contains a divide-by-10 output. This output completes one clock cycle for every 10 on the clock-input pin. The beauty of this is that you can easily gang more than one of these devices together to get longer counts.

As it happens, its also one of the easier CMOS ICs to obtain as well.

(Unfortunately, a number of manufacturers are winding down their production of CMOS ICs. While they should remain around for some time to come at least, it will mean that we'll have to become more creative with what they leave us with. The other problem is the growing trend away from our customary DIP (dual in-line package) ICs and towards surface mount components — great if you've got a magnifying glass for a head, but pretty tough to use otherwise. Anyway, I digress...)

The basic circuit

Fig.1 shows a very basic circuit and is a good place to start. As you can see, there's little to it and, no doubt you've seen it in plenty of places before.

Using a 555 timer IC to create an oscillator, the output signal from pin 3 is connected to the clock input of IC2, our 4017. Each of the outputs is connected up to a current-limiting resistor and a LED. On each clock pulse, successive LEDs will light up.

Now while this circuit works, it's actually a good example of what you *shouldn't* do. Most CMOS ICs have fairly gutless output stages, which means that they can only sink or source a few milliamps. While our circuit won't cause the output stages to blow up, the load is strictly speaking too much. For this circuit, you should really connect each output to a transistor driver circuit to lessen the load. The minimum load you should have on any normal CMOS output is 5kΩ.

If you consider that with a supply rail of 15V, you're going to see 3mA running through this load, that's about as much as you'd want. Any more and you should use the driver idea.

Note too that the IC has a reset (RST) input and a clock enable (CLK EN) input. When you pull the reset input high, the divide-by-10 output goes low and the '0' output goes high. Regardless of what's happening to the clock input, the counter will only advance when the clock enable pin is low. Remember — that's LOW.

If nothing else, there are plenty of inconsistencies in the CMOS logic. Some ICs have enables that have to be pulled high, others low. There's no formula or quick rule-of-thumb you can apply. The only thing you can do is to check the data sheet before you start.

As with other CMOS ICs, don't take the supply voltage above 15V or below 3V. More than 15V and you risk

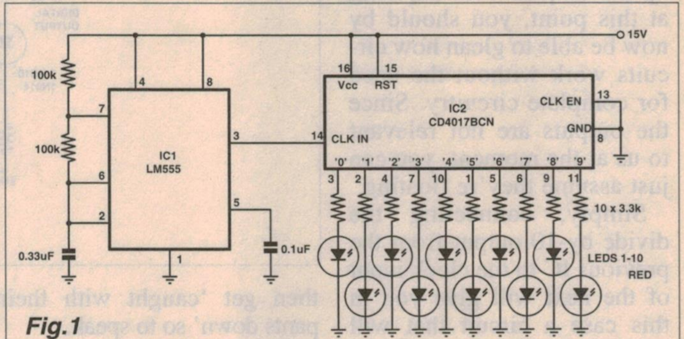


Fig.1

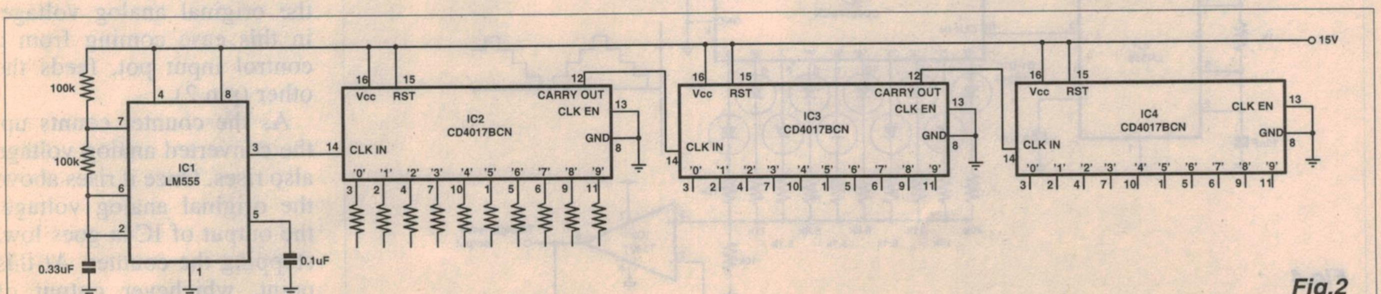


Fig.2

blowing it up; below 3V and it won't work properly.

Stringing them up

OK, so we've got one to work, but you can string as many of these together as you like. The circuit in Fig.2 shows you how to string three 4017s together and as you can see, it's not too difficult. While we haven't wired up the outputs with anything at this point, you should by now be able to glean how circuits work without the need for complete circuitry. Since the outputs are not relevant to us at the moment, you can just assume they're floating.

Simply, connecting the divide-by-10 output from the previous IC to the clock input of the next will give you in this case a circuit that will count up to 999.

Maximum clock speed

Something that we haven't spoken about is the clock-input frequency. CMOS ICs are not known for their speed. The highest frequency you can apply to the clock input is around 4-5MHz, after which the circuit goes a bit haywire. The reason is that it takes the CMOS junctions a certain amount of time due to capacitance to change their state from either high to low or low to high. If the clock frequency is too high, the junctions haven't had enough time to change and then get 'caught with their pants down' so to speak.

CMOS chips are known for their low power consumption, but like most things, you have to trade something off for that. Well, you did in 1969, anyway. These days, there are much faster logic families that can run more than ten times as fast. The 74HC logic family is a good example, however they have much more strict voltage requirements that may not suit battery operation — so you still have to compromise somewhere in order to obtain lightning speed.

An A-to-D converter

I've never seen anyone use this circuit for teaching, but it is an example of what a little imagination can do.

Analog to digital converters or ADCs, like their name suggests, convert an analog voltage into a digital number. These days they're used in everything from CD players to mobile phones.

This little circuit creates a 10-level ADC. It's crude and not extremely practical, but unless you have a huge junkbox, quite often you have to create something out of nothing. To give you an idea how crude, your average CD player uses an ADC that has over 65,000 levels.

Looking at the circuit in Fig.3, you can basically break it up into five parts: (a) the clock generator; (b) the sample clock generator; (c) the DAC; (d) the buffer and (e) the comparator.

While the sample clock generator output at pin 3 of IC5 is low, the clock generator IC1 is allowed to clock the 4017 counter. Now note that the outputs of the 4017 are connected up to a string of resistors. This string converts each digital output to an analog voltage with the '0' output the lowest contributor or least-significant-bit (LSB) and the '9' output or the most-significant-bit (MSB) providing the most output. This is actually a crude but effective *digital to analog converter* or DAC.

The resulting analog voltage is then fed to buffer IC3 and then comparator IC4a, which is half of an LM393 dual comparator IC. The converted digital signal is fed into one input (pin 3) while the original analog voltage, in this case coming from a control input pot, feeds the other (pin 2).

As the counter counts up, the converted analog voltage also rises. Once it rises above the original analog voltage, the output of IC4a goes low, stopping the counter. At this point, whichever output of IC2 is high, that becomes the

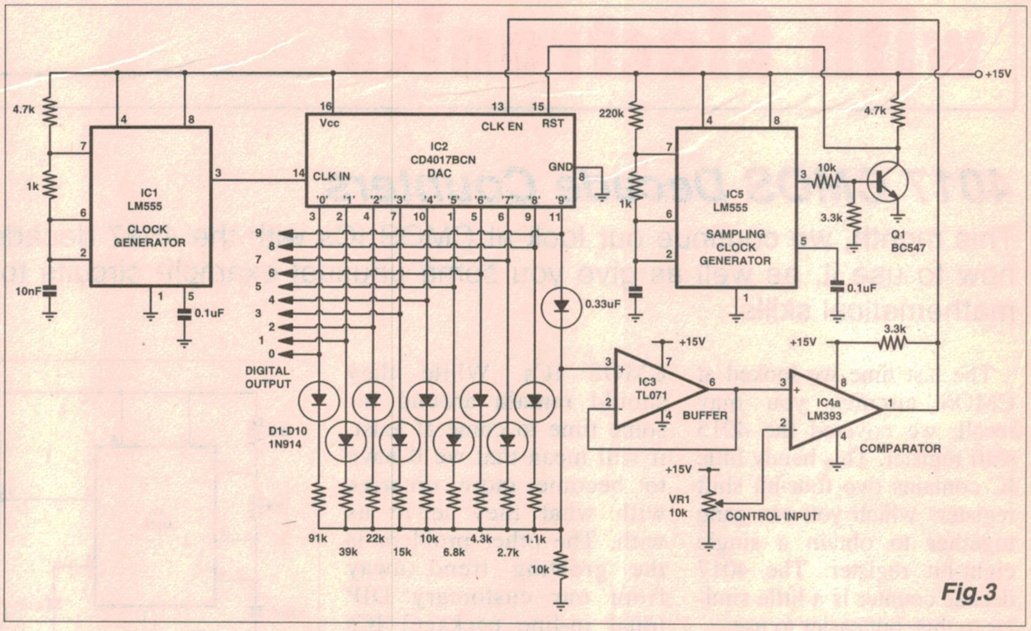


Fig.3

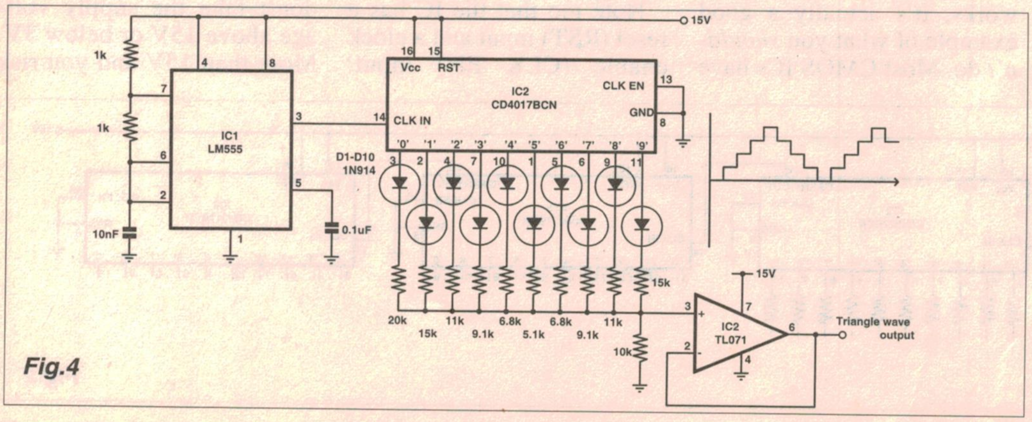


Fig.4

digital value.

After a short time, the sample clock generator IC5 produces a narrow positive pulse, resetting the 4017 output (via Q1) and allowing the sampling or 'conversion cycle' to begin again.

Now the trick with this circuit is to have the sample generator run much slower than the clock generator. That way, the 4017 output shows the digital output for much more of the time. With this circuit, we're using it as more of an educational thing rather than anything else, so the input voltage is simply created by using the wiper of a pot, which is strung between ground and the supply rail. The sample generator runs at about 3Hz, so you can see the digital outputs follow you as you vary the pot control.

You could use this circuit as the basis of a visual digital volume control or a simple level indicator. I would run the sample generator around 100 times slower than the clock generator, and I wouldn't run the latter faster than about 10kHz, which should give you a sample rate of about 100Hz.

Analog to digital converters are now a big industry on their own, with most manufacturers supplying one-chip solutions at a fairly modest cost. While this circuit isn't all that practical, it does show you that there is quite a bit involved even for a simple ADC of this nature.

Triangle wave generator

You can also use the 4017 to create different waveforms of specific frequencies. The idea for this circuit borrows from the ADC we looked at in Fig.4, but instead of producing a linear rise in output voltage from each successive digital output, we simply choose a resistor combination that will give us the response shown in Fig.4. Each output gives us a step in the staircase waveform.

Simply, the 555 provides the clock signal which is fed into the clock input of IC2. On each clock pulse, the next output goes high to supply the next part of the waveform. The diodes connected to each output ensure that when each one goes high, no other output affects the loading. Without the diodes, the output voltage would not only be a function of that particular output but of all the others as well. The diodes simply take the remaining outputs out of the picture.

The buffer op-amp here is important. Since we are dealing with CMOS outputs, any significant load on the output will simply reduce the amplitude. The op-amp provides a buffer so that this doesn't happen.

Note that since this output is a function of the clock-input frequency, if we vary the clock, we also vary the output frequency. Note too that the output frequency will be exactly 1/10th of the clock frequency.

The circuit in Fig.4 is pretty basic and gives you plenty of room to change around the components and add to it. For the more basic sound-generation applications, this circuit will work well but for more specific applications, it may have too many other harmonics. As it is, the output signal will have a fairly large high clock frequency component in its frequency spectrum.

If the application isn't too critical, you could filter out the clock frequency using a simple RC filter connected to the output, which is tuned to about five times the triangle wave output frequency. In this circuit, it's a bit difficult to remove the clock frequency since the waveform itself is made up of fixed amplitudes of various harmonics.

Sawtooth wave generator

By using a 4017, we can control the amplitude of each of the 10 sections or outputs that make up our waveform. Using the circuit in Fig.5, you can make an easy but effective rising sawtooth waveform generator. The only real change to the circuit is the resistor values on each of the ten 4017 outputs. Again for similar reasons as before, this waveform is made up of harmonics so it will be hard to get rid of the clock frequency. If you can remove that, you'll end up with a much smoother ramp instead of the inevitable 'staircase' you get from this kind of circuit.

If we employed more steps by say using two 4017s instead, we would have more outputs and the steps in the output waveform would be smaller. In that case, the output would be say 1/20th of the clock frequency and much easier to deal with. The down side is that you need an extra IC.

If you want to have a go, just try using the circuit in Fig.2 as a basis.

The other difference in this circuit is the pot added to the 555 timer. Using the components shown, the 555's frequency ranges from 1.39kHz to 48kHz. By the time that's gone through the 4017, our sawtooth waveform will vary from 139Hz to 4.8kHz, which isn't too bad a range to work with.

Sinewave generator

By changing the values again, you can create a digital sinewave generator as well — still using the same circuit configuration. If you leave the clock generator components the same, you'll get a sinewave output from 139Hz to 4.8kHz using the circuit in Fig.6.

Working out the component values for the 4017 outputs is a bit more difficult since you have to divide the sine waveform in ten 36-degree increments and then calculate the various parameters. It would take even longer to describe how to do this than it did for the triangle waveform, so just take it that these values work.

However, a sine wave doesn't (or isn't meant to) contain any harmonics. That puts us in a much better position to remove the unwanted harmonics fairly easily, using a simple tracking filter.

Variable circuit

To make the filter track with a varying clock frequency, you'll have to use a dual ganged pot, one section selecting the frequency and the other connected up to the filter. The trick you'll have to remember is that since the value of the pot controlling the clock generator is directly proportional to the frequency, you may have to add another resistor in series or parallel with the filter section of the pot. This is to make sure that the filter tracks with the triangle wave output.

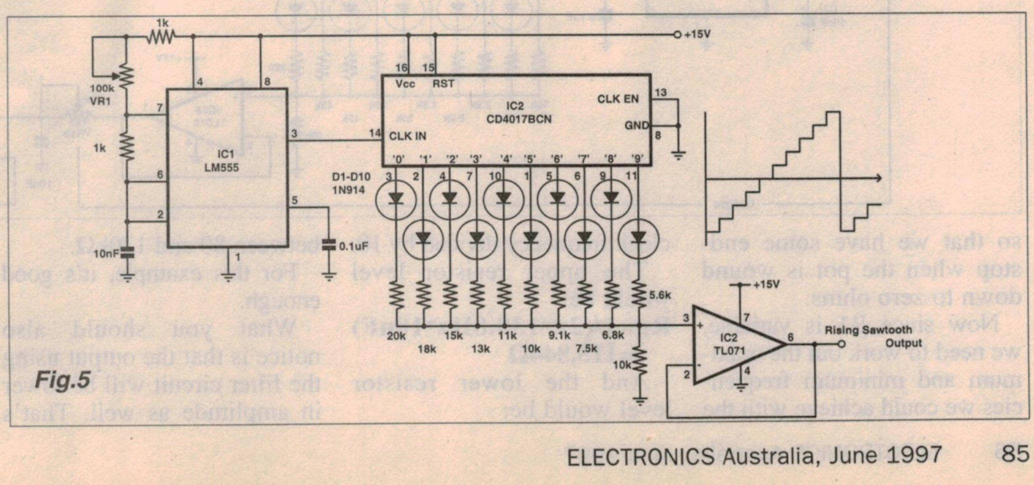


Fig.5

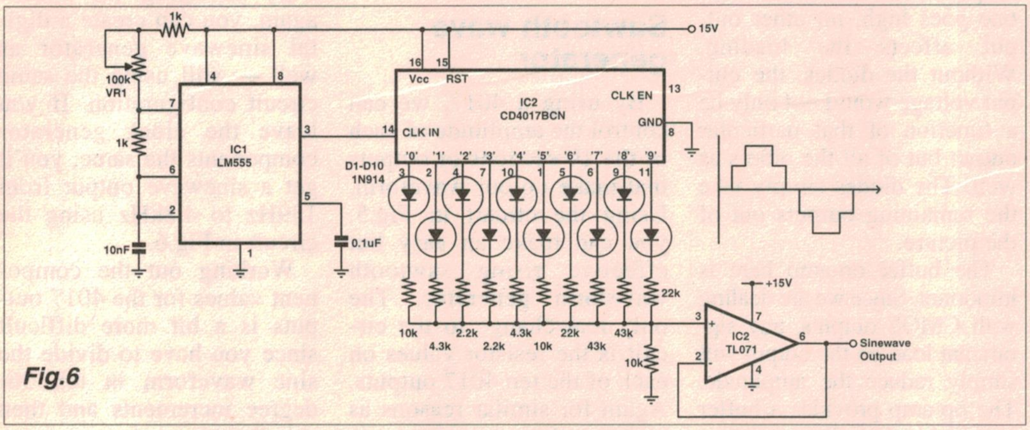


Fig.6

If that sounds confusing, read on and the following example should make it clearer. Sorry about the maths, but it's hard to avoid once you start designing your own circuits.

The example of this circuit is shown in Fig.7. Note that the 555 timer is used as the clock generator, with VR1a controlling the frequency and VR1b doing likewise for the filter frequency. The 555 circuit is just the basic configuration with the clock frequency being equal to:

F=1.44/((R1+(2*R2))*C1)

Where R2 and C1 are fixed and R1 is the pot value plus the 1kΩ buffer resistor. The reason for the 1kΩ resistor is so that we have some endstop when the pot is wound down to zero ohms.

Now since R1 is variable, we need to work out the maximum and minimum frequencies we could achieve with the pot. Say for example, R2 = 1kΩ, C1 = 10nF and R1 = 101kΩ (a 100kΩ pot plus the 1kΩ buffer resistor).

The maximum or upper frequency would be:

Fu=1.44/(1k + (2*1k))*10nF) =48kHz

And the minimum or lower frequency limit would be:

Fl=1.44/(101k+(2*1k))*10nF) =1.398kHz.

Now to achieve those frequency limits with the filter resistor, which is the other section of the pot, we need to work out the maximum and minimum resistor levels at these two frequencies according to the formula we used before. Remember that the triangle output frequency is the clock frequency divided by 10.

The upper resistor level would be:

Ru=1/(2π*139.8Hz*10nF) =113,844Ω

And the lower resistor level would be:

Rl=1/(2π*4.8kHz*10nF) = 3315 ohms.

Hopefully, you'll see that the filter section requires a change of 110kΩ to track the frequency of our triangle output, but that our pot only has 100kΩ in it.

Normally, at this point I'd suggest upping the filter capacitor from 10nF to 12nF. This would drop the resistor change to less than 100kΩ. Unfortunately, or fortunately in our case, pots are horrendously inaccurate components. Most of the ones you would buy from your local electronics store would have a tolerance of +/-20%. This means that for a 100kΩ pot, you could get anywhere from between 80 and 120kΩ.

For this example, it's good enough.

What you should also notice is that the output using the filter circuit will be lower in amplitude as well. That's because the filter points for the formula we've used are known as '3dB' points which means the output of the filter is 3dB down or 0.707 of the amplitude feeding into it. This is an optimum point because it gives us maximum harmonic reduction while still giving us as much amplitude as possible.

If you need to, you can amplify the signal to gain back the signal amplitude. The important point to remember is that the filter is only designed to remove the clock frequency component in the waveform. You can actually vary the values of the 4017 output resistors to your heart's content (within practical limits, of course...) and the filter arrangement will still work.

You can now create whatever waveform you like between the frequencies of 139Hz and 4.8kHz. Not bad for a 4017 and a little bit of filter knowledge! Hopefully, you can see the importance of a little mathematics as well...

OK. That's enough for this month. You should have plenty to do and plenty to experiment with, which is exactly what we're on about. By the way, if you've created any circuits yourself which you think are interesting developments of what we've done here, why not send them in?

Next time, we'll continue on with some more circuits. ❖

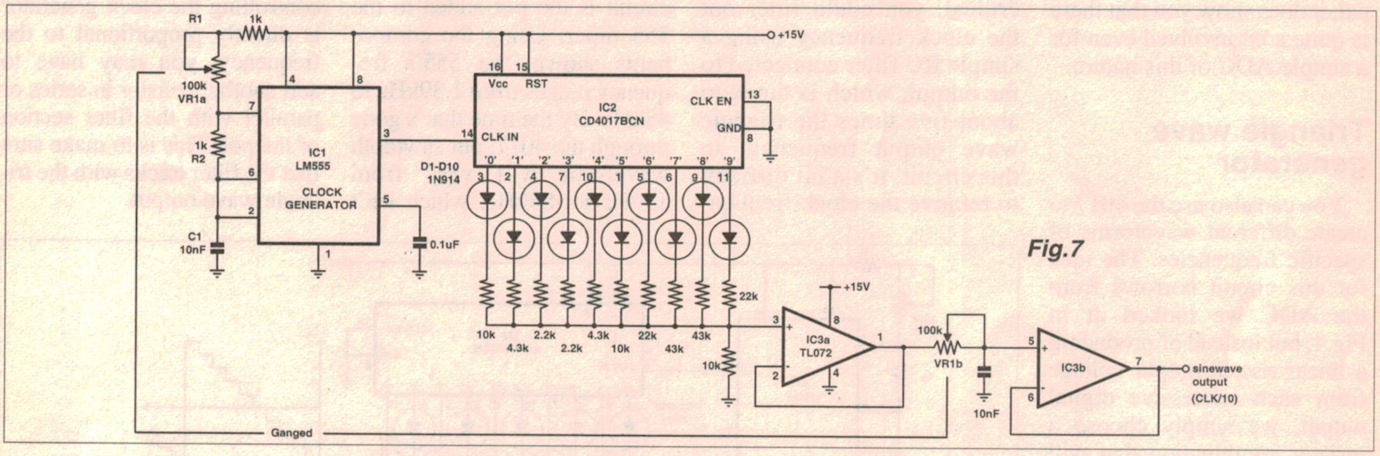


Fig.7

One-Valve Radio

(Continued from page 66)

them, which was really surprising considering there is only one tuned circuit involved. They are between 20 and 30km away from me. The aerial is an 'inverted L' about 10m on one leg and 30m the other leg. In actual fact, the local stations were almost too loud for comfortable listening with the headphones, and the regeneration control had to be backed off to reduce the volume a bit.

Whilst it was once possible to 'hear the World' with this type of receiver, remember that there probably were no more than 1000 radio broadcasting stations in the whole world in the 1920's. Now we have 1000s just in Australia, and interstate broadcast band reception on such a simple set is more a matter of luck and conditions, rather than design limitations of the receiver...

However, given a reasonable aerial (say greater than 30m and as high as possible) and some skill, a lot of fun and enjoyment can be had from such a modest receiver.

The fun is in getting the best from the receiver. In most modern receivers the gain is set and all you can do is reduce it, but with the type of set just described, *you* control the gain and can set the detector to its most sensitive point for every station — not just an average for the whole range covered, as is the case for a modern receiver design.

I'd like to end with a quote from a 1920s *Wireless World* magazine: 'Be a good radio neighbour and don't let your receiver howl (or oscillate) as it spoils the radio reception for others around you'.

References

If you can get hold of any of these books, they'll provide interesting further reading:

Newnes Television and Short Wave Handbook, published by George Newnes Ltd 1934.

RCA Receiving Tube Manual series RC-20-1953.

The Radio Amateurs Handbook, published by ARRL America (almost any year).

Fun With Radio, by Gilbert Davy, published by Edmund Warden Ltd 1971.

Fun With Electronics, by Gilbert Davy, published by Kaye and Warde Ltd 1972.

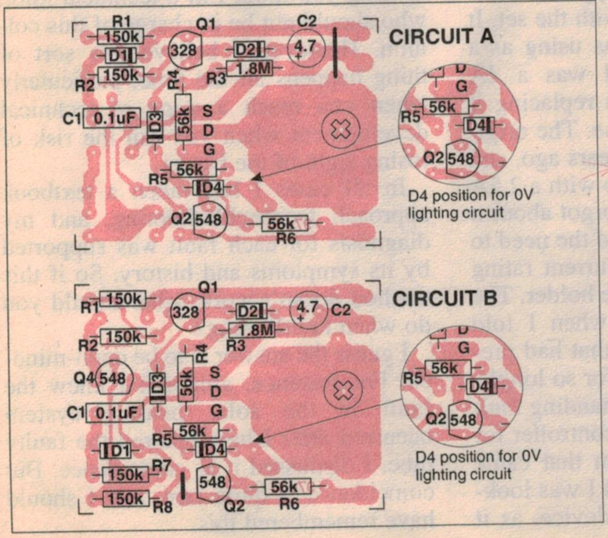
The Oscillation Valve, by R.D. Bangay, published by The Wireless Press, London 1920.

Philips 'Miniwatt' Technical Data Book, 7th edition 1972.

Radio TV & Hobbies, November 1950, page 74. ❖

NOTES & ERRATA

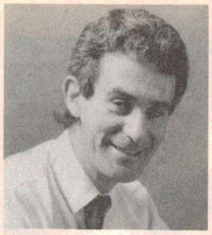
Interior Light Delay for Cars (April 1997): Unfortunately, there was a error in the placement of diode D4 in the overlay diagrams presented on page 57 and 58. The corrected diagrams are shown here, and should be used when assembling the delay circuit.



Playmaster Pro Series Four Preamp (Dec 96 and Jan 97): Some kits may have been inadvertently supplied with CMOS versions of the 556 dual timer chip (IC13), which is used to drive the volume pot motor. As the CMOS type has a much lower output current capability than the normal bipolar 556 and cannot drive the motor, you should check that you have the correct version before it's installed.

The chip type can be tested by using a multimeter to measure the resistance between one of the control voltage inputs (pin 3 or 11) and ground (pin 7). The CMOS versions will cause a reading of around 200k while the bipolar type will measure about 10k.

PC-based DAQ Module (January 1997): An error in the circuit shows pin 17 of U2 going to the junction of pin 4 of J2 and pin 4 of U1. Instead, pin 17 of U2 should connect to the junction of pin 3 of J1 and pin 17 of U1. The error is only in the circuit diagram, and the PCB is correct. ❖



INFORMATION CENTRE

by PETER PHILLIPS

Cable TV, Fibonacci sequences and more

Our topics this month include corrosion related to an antenna mast, how to get out of bed on a winter's morning, an interesting solution to the February What?? question, a couple of corrections — and how a reader has managed to pick up free cable TV transmissions. But first an admission, and one that I think a lot of readers will relate to.

A few weeks ago I decided it was time to fix all the faulty electrical and electronic equipment around the house. You know the sort of thing: faulty lights, appliances, leads and so on. I knew it would take some time to do this, so as preparation before actually wielding a screwdriver, I thought about each fault and either made a mental diagnosis of what was wrong, or what I would have to do to find the fault. However, I fell into a trap I'm sure many technical people encounter: I thought too much.

For example, my low voltage desk lamp wasn't working. Most people would change the lamp, but I had decided that because the desk lamp was new and because the 12V halogen lamp *looked* OK, it had to be the transformer. After pulling it all apart, I discovered the lamp was blown.

A similar thing occurred with a fluorescent lamp. The tube looked almost new, as in fact it was. As well, the tube glowed dimly without flickering, as if it was not getting enough voltage. I diagnosed the ballast, the starter, the lamp holders, anything but the tube. Wrong again!

But the worst example of this 'thought overkill' concerned the family TV set, which had died after a blackout. I suspected an internal fuse, but when I replaced the fuse it blew again in such a dramatic way that I decided there was probably something wrong with the line output stage, caused by a voltage surge when power was restored. This was some months ago, so it was obviously a repair priority.

Having thought so much about it, I knew exactly what procedure I was going to follow to find the fault. First the line output transistor, which being inaccessible took about 15 minutes to remove for testing. Nothing wrong here, so my next step was to check diodes and high voltage capacitors around the line output stage; but again nothing emerged as a possible cause. By now I suspected the line output transformer, as the set was more than 10 years old and had done a lot of work over the years.

To check this, I left the line output transistor disconnected, replaced the fuse and turned the power on. My theory was if the fuse didn't blow, I had isolated the likely section. But the fuse blew, just as forcibly as before. Hmmm...

I removed the vertical deflection board, but the fuse still blew with a bang. From the circuit diagram, it appeared the only remaining section that could cause this was the degaussing circuit. After restoring the vertical and horizontal sections, I unplugged the degaussing coils, replaced the fuse and applied power. Up came sound and picture, so I figured the problem lay in the thermistor that controls power to the degaussing coils. It measured as the correct resistance values, but I broke it apart anyway, convinced I was hot on the heels of the problem. I could find nothing wrong, so I reassembled the thermistor and in the absence of any bright ideas, made a cup of coffee.

And then the 'penny dropped'. There was nothing wrong at all with the set. It was the type of fuse I was using as a replacement. The original was a 2A slow-blow fuse, but I was replacing it with a 2A *conventional* fuse. The original fuse had blown some years ago, and I had replaced it at the time with a 2.5A conventional fuse. I then forgot about it being a slow-blow type, and the need to use a fuse with a higher current rating than that marked on the fuse holder. The family were *not amused* when I told them it was simply a fuse that had prevented them watching TV for so long!

The most technically demanding fault in my list of repairs was a controller for a solar pool heating system that came with my new house. I guess I was looking forward to fixing this device, as it was by far the greatest challenge. I had no circuit diagram, and knew nothing about it, except it was not switching off as it should — which meant the system ran all night, effectively cooling the pool after heating it during the day.

I spent a few enjoyable hours figuring out a design for the system, and even sketched a circuit diagram. I then removed the electronics from the controller box and traced out the circuit. It appeared to work in much the same way as I'd figured, and involved a quad op-amp, a relay and about 20 passive components. It took some weeks before I finally had all the information I needed, and my final diagnosis was a faulty temperature sensing thermistor. But I was wrong again.

There was nothing wrong with the system at all; instead I had introduced an air lock into the plumbing while repairing a hole in one of the solar heating tubes. The air lock was apparently affecting the flow of water around one of the two thermistors. After purging the system, it has worked properly ever since...

I'm describing these events at risk of making you think I'm a technical idiot, who should not be in charge of this column. However, I believe this sort of thing happens all the time, particularly when you reach a stage of technical development when you run the risk of losing sight of the basics.

In all cases I had taken a textbook approach to troubleshooting, and my diagnosis for each fault was supported by its symptoms and history. So if this method doesn't work, what should you do when faultfinding?

I guess the answer is to be open-minded. For instance, although I knew the fault in the solar heating system occurred after I had repaired the faulty tube, I dismissed it as coincidence. But coincidence is quite rare, and I should have remembered this.

Regarding the fuse in the TV set, I should have examined the fuse itself to get the current rating, and not the fuse holder. For the light fittings, you always first suspect a blown lamp, don't you! So if you're falling into the traps I've just described, I hope my honesty in telling you of these events will restore your faith in your own ability. I'm sure I'm not the only one who has had this sort of experience.

True, I fixed all the faults, but I spent far too long doing it. So if this were my living, I'd go broke. Years ago, when my technical skills were still developing, I did in fact earn my living this way, so it seems my increased knowledge has perhaps hindered me, at least when it comes to basic troubleshooting. I wonder how many readers relate to this!

Now to our first letter, which I think you'll find rather interesting. It concerns a cable TV installation in a block of units.

Free cable TV

Recently our block of nine units was hooked up for cable TV. We decided not to subscribe, but imagine our surprise when we found we could pick up a pay TV channel called Arena, as clear as our normal channels. This channel could also be tuned into with our VCR, at UHF channel 3.

I decided to search the other bands and found we could pick up, on channel 4 on the low VHF band, a broadcast that mainly comprised the Discovery channel, although it changed at various times to Fox Sports 1 and 2, and also to channels 7, 9 and SBS. This channel is not as clear as Arena, but is still watchable.

My TV set can pick up other channels, but the transmission is scrambled, so all we get is intermittent sound. I tried tuning the TV set in the unit below, but could not get any of the channels I was able to pick up. My TV set could have a strong tuner, as it's a recent model NEC receiver, with cable channels S1 to S20. But how is it possible to receive pay TV channels without a decoder unit? (Chris McMahon, Coolangatta, Qld)

If you have a satellite dish Chris, it's possible to pick up inter-station transmissions that could include unscrambled pay TV channel information. But I gather your installation is cable, and not satellite. As far as I know, the signal for cable TV is encoded at its transmission point, so casual reception would merely give a scrambled result. But if the installation is supplied by a satellite dish, it's possible you are receiving a signal from the downconverter, giving you the reception you describe. Unusual, but possible.

Another possibility, though remote, is that a pay TV subscriber in the block of units has a TV transmitting device to send a selected pay TV channel to another TV set within the unit. Perhaps you're picking up this signal, although it doesn't explain being able to get more than one channel. Perhaps a reader might know more about this phenomenon, as I'm sure there's lots of interesting things happening out there with cable TV reception.

Lawnmower ignition

These days virtually everything has something electronic in it, including the humble lawnmower. Our next letter seeks advice on the ignition unit in a Victa mower:

Recently my Victa lawnmower stopped, and on checking it, I found it had no spark. I measured the AC output of both the primary and secondary windings of the magnet assembly, and confirmed the readings agreed with those from a similar working mower. This left the ignition module, so I bought a new one ($26), and after fitting it, the mower worked.

Many lawnmowers have a similar ignition module, which has the interesting feature of only having two terminals. The metal case of the module is one, and the other is an insulated quick connect terminal which goes to the hot end of the primary winding from the magnet assembly.

My question is, have you or your readers got any ideas about how these things work? (David Allen, Findon, SA)

The principle of an ignition module is to replace the make and break switch traditionally performed by contacts, which of course you already know David. Because the only input is the voltage from the magneto assembly, my guess is that the switching signal is derived from the input voltage. That is, the device inside the module fires when the input voltage reaches a certain value.

While I don't know how this is done in a typical ignition module, I can think of various ways. For example, an SCR will fire when its anode-cathode voltage exceeds a certain value, although this method might be unreliable. An SCR will also fire if the rate of change of the voltage across it is fast enough. Another way is with a string of series resistors connected across the two terminals, with a tapping to give a trigger voltage to the gate of an SCR.

But I'm guessing, so perhaps a reader might know. The module is shown in Fig.1. I gave up on petrol mowers years ago, and use an electric mower. So far I've replaced virtually every part several times, but at least I'm in control when it comes to repairs!

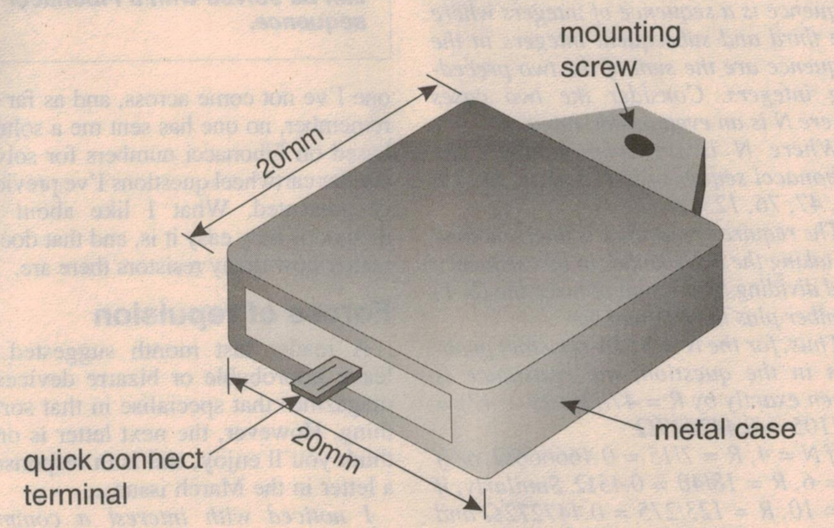


Fig.1: This ignition module is from a Victa lawnmower and has only two terminals. How does it work?

Fibonacci sequence

Ever heard of a Fibonacci sequence? I have, but not from electronics, and to be honest I really have little knowledge of the topic. The next letter is from a reader who used a Fibonacci sequence to solve the February cartwheel resistor network. While we've finished with this problem, I think you'll be interested in what the writer has to say, and to learn

about this sequence. The circuit for the problem is shown in Fig.2.

I was most interested in the imaginative way you solved the resistor network problem in February's What?? question. However, in a computational sense at least, your initial simplification actually complicates the problem and obscures the fact that as the number of resistors in this type of problem is increased, the labour to solve it need not markedly increase.

Application of Kirchhoff's laws points to the following general solution. For a network of N 'radial' and N 'circumference' 1Ω resistors (i.e., a total of 2N resistors) in the cartwheel arrangement of the question, the resistance between any 'circumference' node and the central node can be computed by the use of Fibonacci numbers. A Fibonacci sequence is a sequence of integers where the third and subsequent integers in the sequence are the sum of the two preceding integers. Consider the two cases where N is an even or odd number.

Where N is an even number, the Fibonacci sequence is 1, 3, 4, 7, 11, 18, 29, 47, 76, 123, etc...

The required resistance is then obtained by taking the Nth number in this sequence and dividing by the sum of twice the (N-1) number plus the Nth number.

Thus, for the N = 8 (16-resistor) problem in the question, the resistance is given exactly by R = 47/(2 x 29 + 47) = 47/105 = 0.447619Ω.

If N = 4, R = 7/15 = 0.466666Ω, or if N = 6, R = 18/40 = 0.45Ω. Similarly, if N = 10, R = 123/275 = 0.447272Ω and if N = 20, R = 15127/33825 = 0.447213599Ω.

If N is an odd number, the more familiar Fibonacci series of 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, etc applies. Using the above method where N = 3, you get R = 2/4 = 0.5Ω. If N = 5, R = 5/11 = 0.454545Ω, if N = 7, R = 13/29 = 0.448275Ω and if N = 9, R = 34/76 = 0.447368Ω. Finally, if N = 19, R = 4181/9349 = 0.447213605Ω.

Notice that as N increases the resistance steadily decreases towards a limiting value. This limiting value is when N = infinity, and R = 1/√5 = 0.447213595Ω.

The limiting value is very closely approached when N = 20 (i.e., 40 x 1Ω resistors) and the addition of further 'radial' and 'circumference' resistors in pairs will have little effect. (John Baldas, Viewbank, Vic)

Many thanks John, for this solution. It's one I've not come across, and as far as I remember, no one has sent me a solution based on Fibonacci numbers for solving similar cartwheel questions I've previously presented. What I like about this method is how easy it is, and that doesn't matter how many resistors there are.

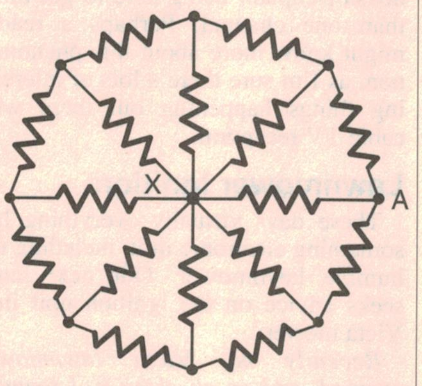


Fig.2: The resistive network that can be solved with a Fibonacci sequence.

Forces of repulsion

A reader last month suggested we leave improbable or bizarre devices to magazines that specialise in that sort of thing. However, the next letter is one I think you'll enjoy, and is in response to a letter in the March issue...

I noticed with interest a comment from a correspondent about recent experiments in anti-gravity, involving a cat with buttered toast strapped to its back. Unfortunately, the proposed device suffers from a fatal flaw — it assumes that the tendency of the toast to land butter-side down is due to a repulsive force between the ground and the unbuttered side. No such force has ever been demonstrated. Indeed, if the force involved was repulsive, then toast with no butter at all would hover by itself, and the cat could be dispensed with.

It appears instead that the behaviour of the toast is determined by an attractive force between the butter and the ground, proportional to the cost of the carpet, as your correspondent has noted. The cost of the carpet rules out the possibility of using this device as part of an anti-gravity machine.

Recent research has concentrated instead on pairs of objects which demonstrate a single repulsive force, such as dirty underwear when thrown in the direction of the laundry basket. (Jeff Richards, West Ryde, NSW)

Now that you mention it Jeff, I reckon there's a repulsive force between *any* object and the device it's aimed at. If only we could tap into this pervasive and embarrassing force, we could turn bad judgement into flight!

Macrovision URL

In March I gave a corrected address for the Macrovision Web site, as sent to me by a reader. However another reader has left a message on our BBS pointing out that the address I gave is *still* wrong. Here's the message and hopefully, the correct Web address:

I am just trying out your BBS, as I wanted to let you know that the Web address you gave in March is incorrect, as it was aborted when I tried it. However, after experimenting, I found a tilde (~) before filipg is missing. The address that works is: **http://www.paranoia.com/~filipg/HTML/LINK/F_MacroVision.html** (Peter Dettman, Moonee Ponds, Vic)

Thanks Peter, hopefully we've got it right at last. And while we're fixing errors, here's another...

Wavelength mistake

In February, I discussed a long wire AM antenna in response to a letter from Ron Voller (St Georges Basin, NSW). It appears that either I or my calculator made a rather large error, as this letter explains:

I want to draw your attention to your discussion on AM antennas, on page 97 in the February '97 issue. Your calculator should have come up with 75m, not 750m for a quarter wave 1MHz antenna. This frequency is roughly the centre of the AM band, and practical examples of a quarter wave transmitting mast abound. A 750m tower would be a real corker!

Long wire receiving aerials on the AM band in early times fed into a high impedance aerial input on the receiver and so the longer and higher the wire the better. Even so, there would have been few quarter wavelength aerials. It's good to read that experimenters like Ron Voller are still around. (Ron Searle, Bundaberg, Qld)

As you can tell from this error Ron, I've had little practical experience with this sort of thing, as otherwise I too

would have seen the error. Still, as I've said before, in electronics, no one person can be expert in all of its many fields. So thanks for correcting me. I just hope Ron Voller isn't trying to find a cheap outlet for 750m of suitable wire, when 75m is all that's needed. Still, as you say Ron, this type of antenna is not generally used, so I guess my error is unlikely to have had much impact.

Corrosion

In the March issue, I presented a letter from Ken Watson (Nambucca Heads, NSW) who pointed out, in reply to a letter in the December '96 edition, that corrosion between an aluminium antenna mast and galvanised steel brackets is not a problem. The next letter takes this topic a bit further, and gives us a source of information about this sort of thing:

In reference to your discussion on corrosion of dissimilar metals in March, I refer you to the Australian Standard 4036 on the subject. It's a slim but effective document.

For corrosion to occur, there must be: (1) electrolyte trapped between the metals in contact, (2) significant electrochemical dissimilarity between the metals and (3), the corrosion product must be of a type that doesn't inhibit further action.

Aluminium serves well in air; so does zinc. In contact, corrosion depends on the entrapped moisture and dissolved salt content, and also greatly on the time before thorough drying out occurs. The result of aluminium/zinc (galvanising) is that the aluminium will corrode. (Brian Byrne, Indooropilly, Qld)

Brian is also the chairman of the Standards Committee MT14/6, hence his ability to give us a publication number. Thanks for this information Brian, as it gives readers who are concerned about corrosion a publication they can refer to.

Fade-up light dimmer

If you find it hard to get up in the morning, perhaps the next letter will not only explain why, but give you a way of getting around the problem.

Have you heard of season affected disorder (SAD)? The most common symptom is that you find it harder to get up in the morning, because you see the dark outside, and assume it's still night.

To get around this, I'm looking for a combination alarm clock and light dimmer circuit, in which the dimmer slowly raises the light level over say 10 minutes before the alarm kicks in. Have you ever seen such a device, or do you know of a circuit to fade lights over a timespan of 10 minutes? (Alan Cambell, BBS)

We described a light dimmer circuit in the June 1992 issue that does exactly what you want, Alan. This unit has adjustable fade up and fade down, as well as an LDR to sense ambient light to stop the dimmer operating in daylight conditions. It would not be difficult to modify the circuit to have it operate from an external trigger.

Fluoro light dilemma

The following letter offers another way to get you out of bed. It's actually about a fluorescent lamp that glows when power is turned off — and as our correspondent explains, he uses this lamp as an alarm clock.

Last winter, I found I had to draw the blinds to keep in the warmth, but the darkness of my room made it difficult to get up for those inevitable early starts. So I set up a fluorescent light fitting on my bedhead, switched on by a mechanical timer. The lamp was connected to a GPO and operated with a switch in the fitting that switched the active wire. However, when I connected the lamp to the GPO with an extension lead of dubious origin, I discovered that the tube would glow very slightly when it was turned off.

I eventually found that the active and neutral wires in the lead had been swapped, and rewiring the lead fixed the problem. The lamp is now totally dark until some ungodly hour in the morning when the timer turns it on. By the way, a 30W Daylight fluoro tube about 300mm above your head is a REALLY GOOD alarm clock! (John Holland, BBS).

Phew! I think if I did this John, I'd probably accidentally smash the lamp fitting in my awakening struggles. Still, it's certainly a better way to get you out of bed than soft music!

I assume the lamp was glowing because of the capacitance between the active lead and earth. A ballast has enough capacitance to cause some leakage, obviously enough to make the lamp glow. It shows how important it is to switch the active lead, and not the neutral.

Amateur band antenna

The next letter seeks information about building an antenna for the novice amateur band.

Have you ever described a project for an antenna to suit the novice amateur band? Also, how about a converter for 27MHz CB to 28MHz? (Chris Gresham, Cowan, NSW)

I've searched our database, but I can't find any project that would suit your needs, Chris. We've described an SSB receiver for the 80m amateur band (Sept and Dec '91), but no antenna designs. The only reference I can find for a 27MHz converter is a project described in January 1977. I don't have a copy of the article to hand, so I can't tell much more about it.

What??

Our question this month is a bit of a challenge. According to a report by three learned societies in Britain, 95% of a group of incoming university students intent on studying maths could not solve it. The question was sent by Peter Steel, who explains that it was presented some time ago in *New Scientist.* No answer was given, but Peter has provided an answer that uses basic trigonometry. See how you go:

Calculate the area of the shaded portion of the circle shown in Fig.3.

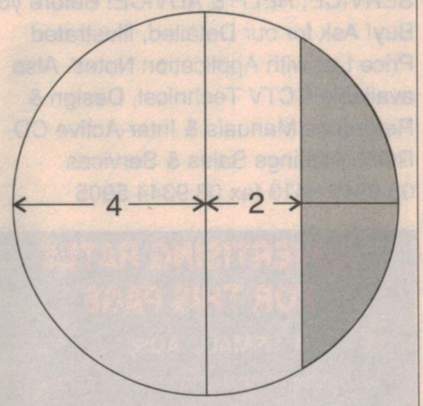


Fig.3: Find the area of the shaded section of the circle...

Answer to May's What

By my calculations, you need a 190Ω resistor in series and an 18Ω resistor across the headphones. ❖

EA'S READER SERVICE BBS

As part of our service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS), which makes available a wide range of useful information for convenient access and rapid downloading. You can also leave contributions to some of our columns.

The BBS is ANSI compatible and is currently operational for virtually 24 hours a day, seven days a week, on (02) 9353 0627. Use any speed up to 28.8kb/s.

MARKET PLACE

FOR SALE

Homemade Generator-plans
URL: http://www.onekw.co.nz/

Amidon Ferromagnetic Cores:
For all RF applications. Send business size S.A.S.E. for data/price to RJ & US Imports, Box 431, Kiama NSW 2533. Agencies at Webb Electronics, Albury; Assoc TV Service, Hobart; Truscotts Electronic World, Melbourne and Mildura; Alpha Tango Products, Perth; Haven Electronics, Nowra; WIA Equipment Supplies, Adelaide.

Send a blank message
to help@dontronics.com for details on how to join our SiClub and List Server Support group. We have a free Basic Interpreter for the PIC16C84. Largest range of PIC related products South of the Equator.

Car/Rally Computer Kit -
fuel sensors, speed sensors.

68HCO5 & HC11 Development Systems - Oztechnics, PO BOX 38 Illawong NSW 2234
Ph: (02) 9541 0310,
Fax: (02) 9541 0734,
http://www.oztechnics.com.au/

PCBs Made, One or Many.
Low prices, hobbyists welcome. Sesame Electronics (02) 9554 9760,
Fax 9718 4762,
skybus@zip.com.au.

EA 85 - 86 over 60 issues
plus t chest of parts from old collector. Blow your mind. Ph 02 9555 1266

Oscilloscope 'Philips' dual trace,
10Mhz, with circuit, $150 including freight. Probes available at extra cost. Another identical oscilloscope available for parts, free of charge, but freight is payable. Ph: 070-45-3264 BH & AH.

A Simple PIC84 Programer:
LED model 6 lights $65, LCD model 16x1 char. $75, pp $5. Others available.

FOR SALE

EST Electronics (02) 9789 3616,
Fax (02) 9718 4762.

WARNING ! WARNING !
VIDEO CAMERA MODULES
Beware of HIGHER prices for a similar Camera! BUY A BETTER CAMERA AT A LOWER PRICE! CHOOSE from..... 380, 420 & 460 Line Resolution. Low Light & IR Sensitive 0.05 lux. TEENY WEENY 28mm x 28mm PCBs. ELEVEN Board Lenses. FOUR Pinhole Lenses. 1R Cut/Pass & Polarising Filters. 845+ nm 74 mW IR LEDs. Ancillary Equipment. BEFORE & AFTER-SALES SERVICE, HELP & ADVICE! Before you Buy! Ask for our Detailed, Illustrated Price List with Application Notes. Also available CCTV Technical, Design & Reference Manuals & Inter-Active CD ROM. Allthings Sales & Services
08 9349 9413 fax 08 9344 5905

ADVERTISING RATES FOR THIS PAGE

SMALL ADS:
The minimum acceptable size of two centimetres x one column costs only $70. Other sizes up to a maximum of 10 centimetres are rated at $40 per centimetre.

CLASSIFIEDS: *$6 for 40 letters. Just count the letters, divide by 40, and multiply by $6.*
ROUND UP TO THE NEAREST MULTIPLE OF $6
MINIMUM CHARGE $12.

CLOSING DATE:
Ads may be accepted up to the 10th of the month, two months prior to issue date.

PAYMENT: *Payment must be in advance by cheque, money order or credit card, include your name, address, and credit card details. Faxes accepted. Payment should be sent with your advertisement, to:*

THE ADVERTISING
PRODUCTION MANAGER
ELECTRONICS AUSTRALIA,
P.O. BOX 199, ALEXANDRIA, NSW 2015
PHONE (02) 9353 0740 • FAX (02) 9353 0997

FOR SALE

$79 ! VIDEO CAMERA MODULES ! $79
ONLY! $79 !!!!! ONLY! $79 !!!!!
Complete with 3.6 mm Board or 5 mm Pinhole Lens, Low Light & Infra Red Sensitive, Tiny 32 x 32 mm PCB. Cat No MOD-BW 506 ONLY! $79 ! ! ! ! !
Allthings Sales & Services
08 9349 9413 fax 08 9344 5905

TV Video Audio TX/RX Modules
up to 100 m range, 915-928 MHz band, $80 pair? with Interfice PCBs $99
Allthings Sales & Services
08 9349 9413 fax 08 9344 5905

INFRA RED ILLUMINATORS
240 vac Auto on/off in Aluminium Housing with Adj Bracket $149. PCB with LEDs $79. PCB with LEDs AND Auto Control PCB $99. DIY LED & PCB Kits: 50 LED 52 mm Round Lamp $50. 88 LED $72. 180 LED $113. Variations include up to 210 LED 34 watt.
Allthings Sales & Services
08 9349 9413 fax 08 9344 5905

*** THE TINIEST * VIDEO CAMERA MODULE PCB** 28 x 28 mm, IR & Low light sensitive, with Pinhole Lens.
08 9349 9413

Construction project:

COMPOSITE SYNC GENERATOR FOR TV

Here's the design for a module which will generate a standard PAL horizontal and vertical sync signal, as well as full composite blanking. Perhaps the most important feature of this project, however, is that it produces a fully *interlaced* sync signal, using only common HCMOS ICs.

by GRAHAM CATTLEY

This project is perhaps a little unusual in that it is really *half* of the original project I set out to design. A new, revised TV colour bar generator using readily available ICs was my original aim, but once I had completed the interlaced sync board, I realised that the sync generator section would make a practical project in its own right.

I suppose you can see this project in one of two ways: either as a self contained, interlaced sync and blanking module, or as the first part of a future fully interlaced colour bar generator. As it stands, the unit will produce fully compliant PAL sync and blanking signals, as shown in Fig.1.

The module can be put to a number of different uses, from amateur television through to modifying an existing colour bar generator to produce an interlaced display. You could even use it as a basis for experiments in generating your own video images — and in the process learn a lot about the structure of the composite video signal in the process.

And one of its main features is that it uses only readily-available HCMOS integrated circuits. I mention this because many of the designs presented in recent years have used custom LSI chips that have either been discontinued, or run the risk of meeting this fate shortly. Hopefully a design based on standard HCMOS devices will have a longer life...

The circuit

The circuit for the generator falls neatly into two distinct parts: the sync generator itself (Fig.2), and the blanking section (Fig.3).

Concentrating for now on the sync section, probably the best place to start is the master clock formed around U1, U2 and U5. The main oscillator U5a, running at

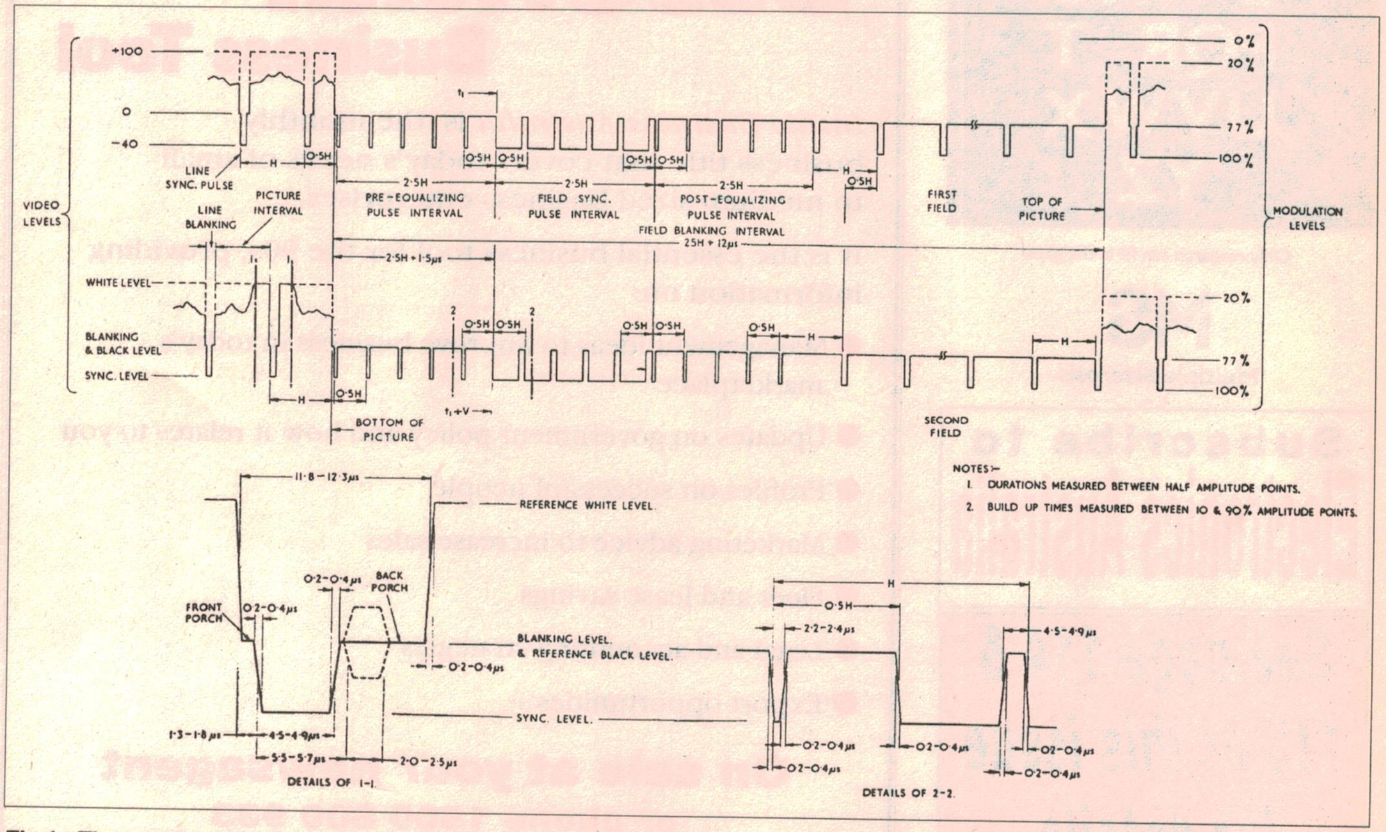


Fig.1 : The top diagram shows the vertical sync block for both fields of a standard PAL video signal. The bottom two diagrams are enlarged views of : (left) the horizontal sync and blanking between each line, and (right) the start of the vertical sync pulse.

4MHz, clocks the four-bit synchronous presettable binary counters U1 and U2. If we assume that U2's D3 input is low, its TC (terminal count) output will pulse high every 64us (256 x 250ns). This 250ns wide pulse is used as the main timing for the sync generator, and also serves as a convenient horizontal sync output.

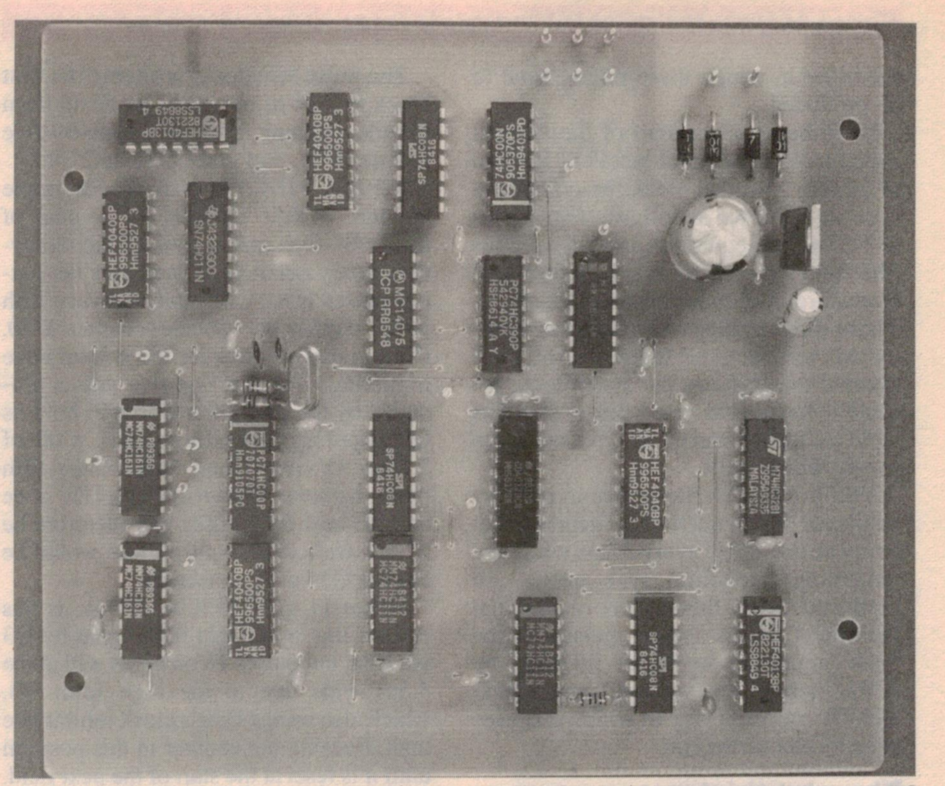
It is important to note at this point that this pulse is not an actual sync pulse, but rather a trigger to the pulse generator to generate the *real* horizontal sync pulse of the correct width at each instant.

Moving on to the pulse generator (U3, 6, 7 and 8, on the left hand side of the circuit), you can see that it consists of a 12-bit binary counter and a small amount of decoding circuitry. The purpose of this block is to produce pulses of one of three different widths, each time it is reset by the trigger pulse from U2.

The width of these pulses is selected by taking high one of the block's control inputs, controlled by the pulse selector block (to be described shortly). These control inputs are effectively pin 10 of U6c and pin 5 of U6b.

If pin 10 of U6c is high, the counter will wait until it is reset by the horizontal trigger pulse, then count at a rate of 4MHz (once every 250ns), and will continue counting until it hits the selected maximum. As soon as the maximum decoded count is reached, the corresponding input to OR gate U8b swings high, and this gate's output then gates the clock off via U5d and c.

As an example, suppose pin 10 of U6c is brought high. The selected decoding would therefore be 9, and so the resulting pulse will be 9 x 250ns = 2.25us.



As you can see, all the parts for the sync generator are contained on the one PC board. This makes it simple to incorporate the generator into an existing design — converting an existing bar generator to give an interlaced output, for example.

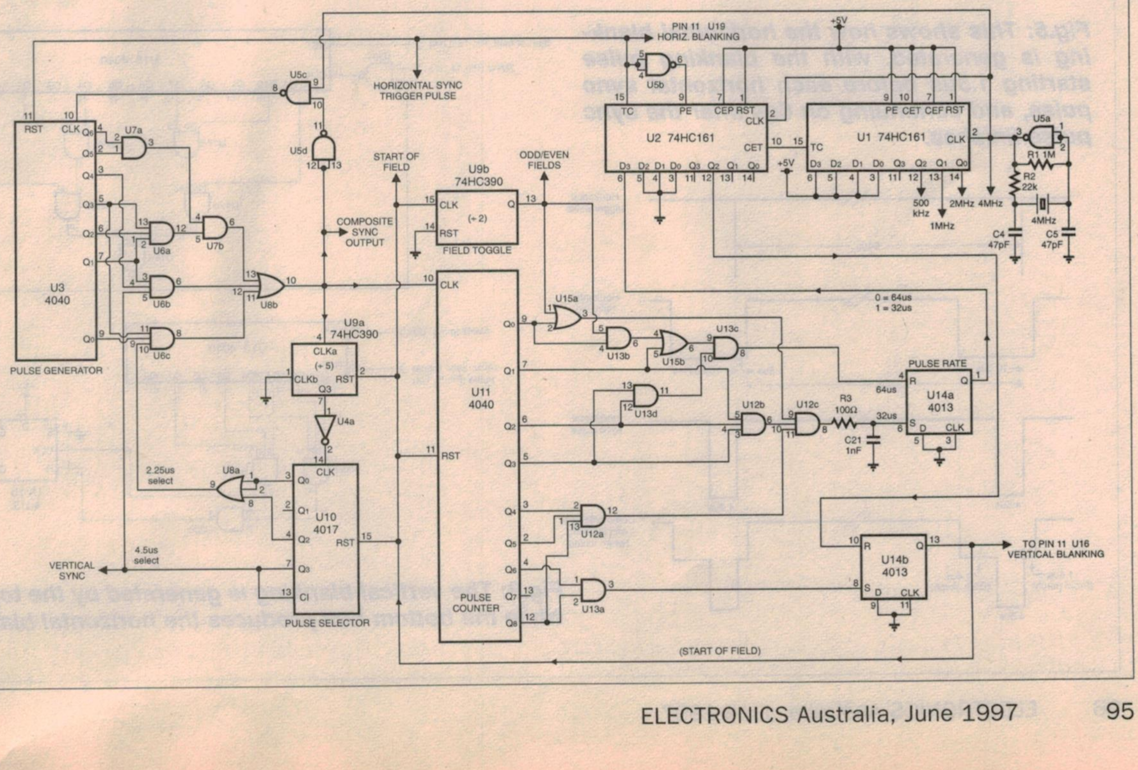
Two other pulse widths are used in the sync generator, and these are selected by either taking pin 5 of U6b high, which results in a pulse width of 18 x 250ns = 4.5us; or both control lines low, giving a pulse of 110 x 250ns = 27.5us.

If you have a look at Fig.1 you'll see that the complete composite PAL sync signal is composed of just these three different pulses, and so the trick is to switch between them at the right time in order to produce the final waveform.

Counting pulses

Having described both the timing and pulse generating blocks, it might be a good idea to give a quick overview of

Fig.2: The circuit for the composite sync generator section. At top right is the main clock and divider chain, while at far left is the pulse generator. The remaining circuitry is devoted to controlling the width and frequency of the pulses throughout the frame.



the order in which these pulses need to be produced.

If we begin at the start of the vertical sync block at the point labelled 'Bottom of picture', we can break the composite sync signal down as follows: five pulses at 2.25us (pre-equalisation); five at 27us (the field sync pulse interval); and then five more at 2.25us (post-equalisation). These three groups of five pulses make up the vertical sync block. In the field interval that follows the sync block, we need a horizontal sync pulse at 4.5us wide occurring every 64us, to take us up to one whole field.

You'll note that the pulses in the vertical sync block need to be generated at a rate of one pulse every 32us, while the remaining horizontal sync pulses are produced every 64us. This means that the speed of the trigger pulses to the pulse generator needs to increase by 100% during the vertical sync block, and I'll cover the way in which this happens a little further on.

The plot thickens

Unfortunately, from here on things get a bit complex, due to the need for a great deal of control and feedback within the circuit; there isn't a single direct signal or control path to follow as you would in a more straightforward circuit. So to try and make this circuit description as simple and as clear as possible, I'll cover each of the main circuit blocks in turn, and then explain how they all fit together at the end.

The pulse selector is probably the best block to look as next; it is made up from decade counter U10, a divide-by-five counter U9a, and gates U8a and U4a.

U9 is a 74HC390 dual decade ripple counter, which consists of a pair of divide-by-five and a pair of divide-by-two binary counters. U9a counts the output pulses from U8b, and on every fifth pulse clocks the decade counter U10. (U4a is used to provide the correct edge triggering.) For the first five pulses produced by the generator, U10 will hold its Q0 output high, selecting a pulse width of 2.25us. On the falling edge of the fifth pulse, however, U9a will clock U10 once and the next five pulses will therefore be 27.5us wide (both control lines would be low, as Q1 isn't connected).

Pulses 11 to 15 will be 2.25us, as this control line is brought high again by Q3 via U8a, but pulses 16 onwards will all be 4.5us wide due to the high from Q3, which also brings U10's clock inhibit line high, freezing the counter in this position until it is reset at the start of the next field.

The next block is the pulse counter around U11, and its purpose is twofold. Firstly, it needs to reset the pulse selector at the end of every field (or at the start of the next, however you want to look at it); secondly it sets the repetition rate of the horizontal trigger pulses to 32us during the first 15 pulses of each frame (the vertical sync block).

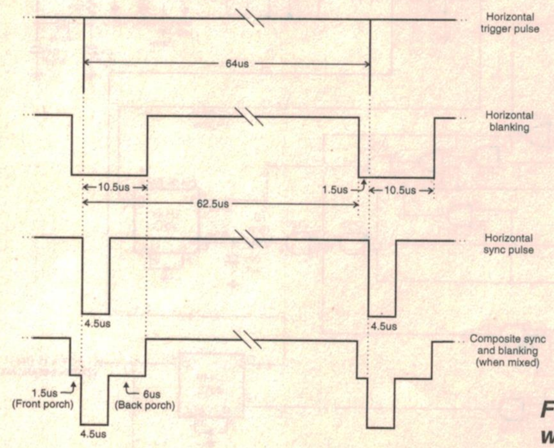
Resetting the pulse selector at the end of each field is easy enough, with U11's Q6 and Q8 outputs ANDed together and setting the flipflop U14b. The purpose of this flipflop is to effectively stretch the output pulse from U13a; as the counter U11 is effectively resetting itself — via U13a — the resulting pulse width can at times be exceedingly narrow and low in amplitude. By setting U14b, a high is produced on its Q output which stays there until the flipflop is reset by the Q2 output of U2, which is toggling at a rate of 31.25kHz. This results in a nice 16us wide 'Start of field' pulse that is used to synchronise almost all the functional blocks in the circuit.

Changing speed

You might be forgiven for thinking that the pulse counter's second function (setting the horizontal trigger pulse to 32us for the first 15 pulses of each frame) was a simple one. But as you can see from the tangle of gates around the outputs of U11, this is not the case.

The reason for this stems from the need to use synchronous counters for U1 and U2. These need to be synchronous because the propagation delays in the more common ripple counters would result in timing errors throughout the circuit. The 74HC161 counters used here solve this problem, and also provide another handy feature — the ability to pre-load the counter with a binary value. Thus if the D3 input of U2 (pin 6) is taken high, the counters are preloaded with 10000000 binary (128 decimal), which is halfway through their normal count. It therefore takes half the time to complete the full count, and as a

Fig.5: This shows how the horizontal blanking is generated, with the blanking pulse starting 1.5us before each horizontal sync pulse, and continuing on 6us after the sync pulse finishes.



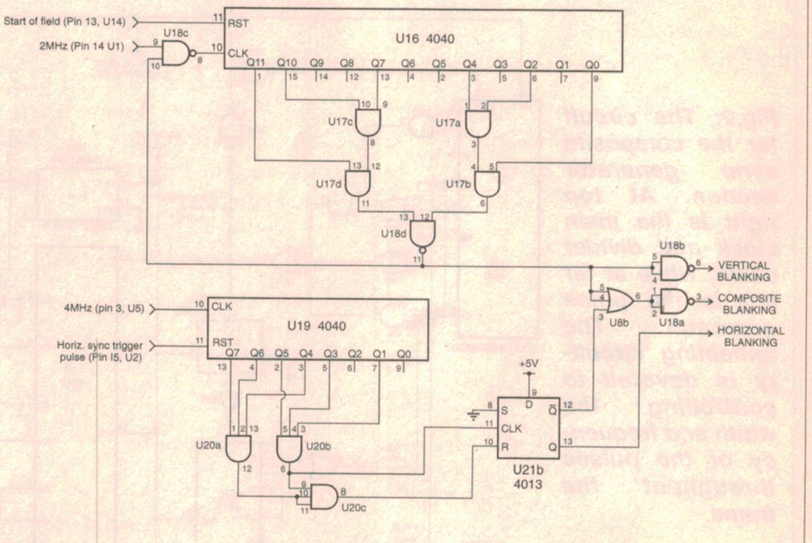


Fig.3: The vertical blanking is generated by the top half of this circuit, while the bottom half produces the horizontal blanking signal.

result the horizontal trigger pulses occur every 32us instead of 64us.

The 'Pulse rate' flipflop (U14a) sets this high order bit of the counter, and is in turn controlled by the decoding around U11.

The major disadvantage with this system of pre-loading the counter is that being synchronous, the counters need to be pre-loaded with 128 one full count *before* the required high-speed trigger pulses are needed. (Of course we also need to load them with *zero* one count before we need it as well, in order to flip back to 64us.)

This task is further complicated by the need to shift every odd field ahead by 32us in order to produce an interlaced display. This function is performed by the 'field toggle' block, which is the second half of the 74HC390 counter (U9b).

U9b is being used here as a divide by two flipflop, which toggles once at the start of every field. Its 'Odd/even fields' output feeds into the gating logic, resulting in the following decoding:

Odd/even fields = 0
64us = 1101 = 13
32us = 100111111 = 319
Odd/even fields = 1
64us = 1110 = 14
32us = 100111110 = 318

The field ends as soon as the pulse counter detects a total of 320 (101000000 binary) pulses (regardless of the current field), resulting in one field every 20ms.

R3 and C21 serve to delay the 32us selection pulse by a few hundred nanoseconds. If you look in the above table, you'll see that when Odd/even fields is 1, the decoded values of 14 and 318 share the same bit pattern in the lower four bits. So when 318 pulses have been counted and decoded, both the 32us *and* the 64us outputs are brought high. In this situation, the flipflop is presented with a high on both its set and reset inputs at the same time, and it is the last input to remain high that decides the output of the flipflop. By delaying the set line by a few hundred nanoseconds, we can eliminate the need for extra decoding and gating in the 64us selection line.

Overview

Now that I've covered each of the function blocks in detail, I'll run through the way in which they interact in the process of generating a complete frame.

Assuming that we start on the beginning of a frame (that is pin 13 of U14 has just pulsed high), U2 will have been pre-loaded with 128 and so the pulse generator will be triggered every 32us. It produces five 2.25us pulses, whereupon U9a increments U10 and five 27us pulses are produced. Then U10 is clocked again, and another batch of five 2.25us pulses are produced.

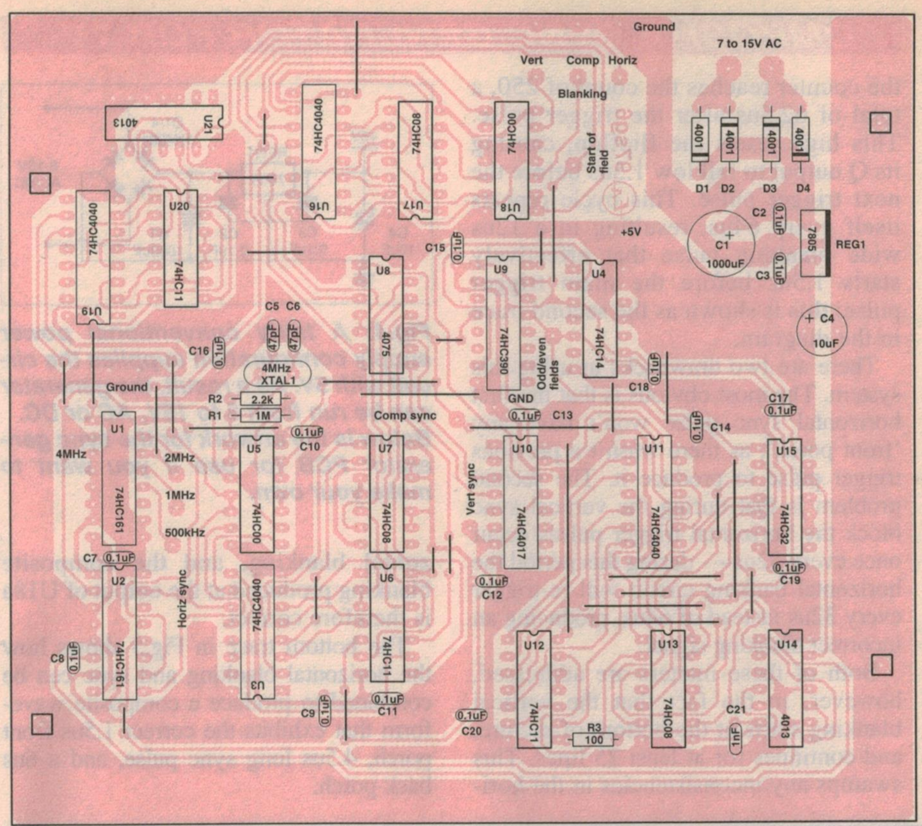


Fig.6: Refer to this diagram when constructing the sync generator, and watch the orientation of the ICs when installing them on the board. Also note that the position of the crystal is different from that in the photo. This was done to make that section of the board a little less cramped and easier to build.

The last of these pulses causes the pulse counter to reset the pulse rate flipflop, and all subsequent pulses in the field occur at 64us. The pulse selector locks into 4.5us and these horizontal sync pulses continue until the pulse counter reaches the end of the field. At this point, the start of field line pulses high (for 16us) and the pulse selector is reset. The Field Toggle changes state and a different set of decoding is switched in, which effectively shifts the vertical sync block ahead by 32us.

The second field then starts with the same set of vertical sync pulses, only this time the following horizontal sync pulses are 32us out of step. Once this second frame ends, the whole circuit is back as it started, ready to produce the first field again.

Blanking

Well, after that last lot the blanking circuitry looks refreshingly simple — see Fig.3. It operates as a completely separate unit, using the Start of field signal and Horizontal trigger pulse for synchronisation.

The vertical blanking is generated by a 4040 12-stage binary counter (U16) that is reset at the start of each field. It is clocked at 2MHz from the Q0 output of U1, and this clock is gated into the counter by U18c. After a period of 1610.5us (that number comes from ((25 x 64us) + 12us)-1.5us, or rather 25 lines plus 12us minus the front porch of 1.5us), the counter reaches its maximum count of 3221, and pin 11 of IC18d swings high, gating off the clock. This repeats at the start of every field, and the resulting vertical blanking output (pin 6 of U18) swings low for the first 25 lines at the top of the screen.

A little bit of thought had to go into the horizontal blanking, as we really need it to start somewhere between 1.3 to 1.8us *before* the horizontal trigger pulse. To picture how this is achieved, take a look at Fig.5 while referring to the circuit. The top trace shows the horizontal trigger pulses occurring at a rate of 15.625kHz (64us).

These pulses reset the binary counter U19, which starts counting at a rate of 4MHz. After 10.5us (42 counts), U20b clocks a high onto the output of the D-flipflop U21. This high remains until

the counter reaches the count of 250, a total of 62.5us after the trigger pulse. This high resets the flipflop, causing its Q output to fall low 1.5us before the next trigger pulse. This cycle repeats itself every 64us, resulting in a 12us wide blanking pulse that effectively starts 1.5us before the main trigger pulse; this is shown as the second trace in the diagram.

There are two drawbacks in using this system. The most obvious is that the first horizontal sync pulse won't have any 'front porch', as there wasn't a previous trigger pulse to produce it. The second problem is that during the vertical sync block the horizontal trigger pulses occur once every 32us — during this period the horizontal banking circuit will re-trigger every 32us instead of 64us, producing an incorrect blanking signal.

Both of these matters are addressed, however, in the fact that the vertical blanking starts at the bottom of picture, and continues for at least 25 lines. This swamps any inconsistencies in the horizontal blanking, and the composite blanking produced at the output of U18a is therefore correct.

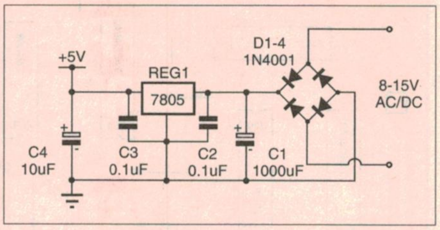
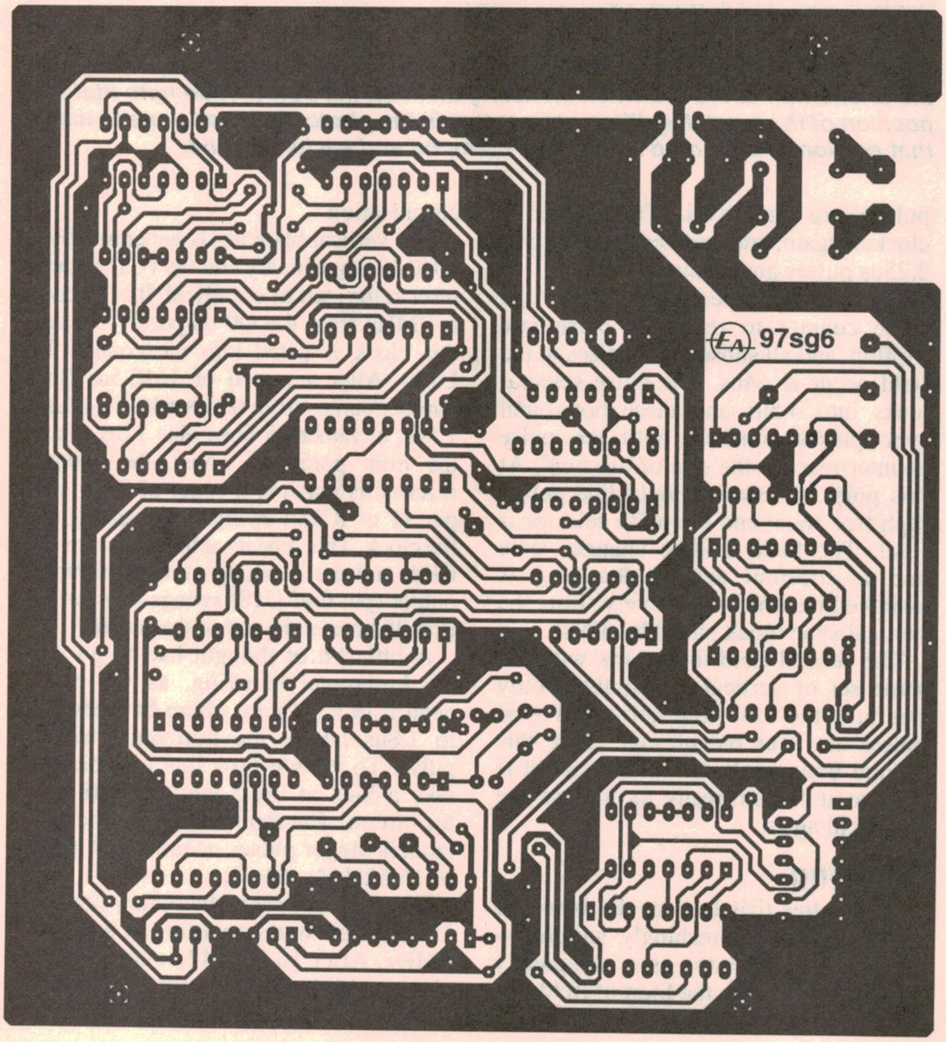


Fig.4: A fairly conventional power supply configuration supplies the circuit with 5V. As a result, the generator can be run from 8 to 15V, AC or DC. Below is the artwork for the sync generator PCB for use if you want to make your own.

The bottom trace in Fig.5 shows how the horizontal blanking and sync can be combined to produce a composite waveform that exhibits the correct 1.5us front porch, 4.5us long sync pulse, and a 6us back porch.



Construction

Construction of the sync generator is relatively straightforward, with the complete circuit mounted on a PC board measuring 137 x 123mm, coded 97sg6.

Begin construction by installing the 30 wire links. These are made from lengths of tinned copper wire, and should be kept as straight as possible to prevent adjacent links shorting.

Once these are in, you can insert and solder the 21 PC terminal pins. Don't be tempted to leave these pins out and solder the wires directly to the board, for a couple of reasons. Firstly, you may need to connect to these points after the sync board is mounted in a case. The other reason is that these pins provide access to some useful signals that can be used to trigger an oscilloscope.

Next mount the 14 monolithic bypass capacitors, three disc ceramics, and finally the two electros. The four diodes and two (yes, only two!) resistors can then be installed, followed by the crystal and voltage regulator. Last but not least are the ICs, all 21 of them.

Observe the usual antistatic precautions when handling these, and note that U3, U16, U17, U18 and U19 are installed with pin 1 facing the front of the board. Double check both the orientation and number of each IC before soldering it into the board, as it's a pain having to desolder them afterwards. (And don't ask me how I know this...)

The PC board has been designed to fit into a standard medium instrument case, with the idea that the companion colour bar board be installed at a later date. I won't go into any detail on mounting the sync module in any particular case, as you may well intend to use the sync generator in another system — adapting an existing colour bar generator to give an interlaced display for example. When the colour bar section is published, I'll cover the installation and wiring of a suitable mains transformer, so if you elect to install the sync generator board in a case, remember to leave room on the right hand side of the case for the addition of a small power transformer.

For now, the sync generator can be run on any existing power supply, so long as it provides an output of more than 7.5 volts to give the 5V regulator a bit of headroom. A small 12V plugpack is a good proposition, as the circuit uses only CMOS and HCMOS ICs. The power consumption is quite low, with the circuit drawing only 7.5mA when running.

The sync generator doesn't have any controls as such, so if you are mounting it in a case, the only holes you'll need to

drill will be for the power socket on the back — and perhaps the various sync and blanking signal outputs.

Testing

As all the timing in the sync generator is generated from the one 4MHz crystal, there is no need to calibrate the unit; with any luck the board will produce full PAL interlaced composite sync and blanking as soon as you apply power. To test this, you'll need an oscilloscope (dual trace if possible) that provides an external trigger.

To start with, apply 9-15 volts to the AC/DC input (don't worry about polarity), and check that the current drawn is around 7-10mA. Next, attach the scope probe to the 'Comp sync' output (just above U7 and U10), and the scope's external trigger to the 'Odd/even fields' pin between U4 and U9.

If you then set the scope's timebase to 0.1ms and positive edge triggering, you should be able to get it to display the whole vertical sync block from the start of each frame. If you now switch the scope to negative edge triggering, you will see that the horizontal sync pulses are now offset by 32us. To confirm that the interlacing is working correctly, move the scope's trigger probe to the 'Start of field' pin, to the right of U18.

Every field will now be displayed on the scope, and it will appear that the horizontal sync pulses are being generated at a rate of one every 32us. They are, of course, being generated every 64us, but every alternate field is meshing in with the last to give this effect. (If you look closely, you might be able to see some flicker in these horizontal sync pulses, while the vertical sync block remains rock solid.)

You can now move the scope probe to the 'Comp' blanking pin at the top of the board. This should be producing a composite blanking signal, but you will probably have to drop your scope's sweep speed down to 0.2ms in order to see it. This is because the vertical blanking runs to over 25 lines, and so you'll need to be able to see at least 1.6ms past the start of field before you'll come across any horizontal blanking pulses.

Well, that's about it for the sync generator. The colour bar add-on board should appear sometime soon, but in the meantime you could knock up a quick-and-dirty mixing circuit using a couple of transistors and a resistive divider. This would combine the TTL level sync and blanking signals into a composite video signal with the correct amplitude of 1Vp-p. (You could even mix in some of the 1, 2 or 4MHz square wave from U1 as some video information, which would translate as vertical black and white bars on the screen.) This composite signal could then be fed into the 'Video in' socket of your VCR to give you an idea of how all of these different video signals fit together as a whole. ❖

PARTS LIST

Resistors

All resistors 1/4 watt, 5%

R1	1M
R2	2.2k
R3	100 ohms

Capacitors

C1	1000uF electrolytic 25VW
C2,3,7-20	0.1uF monolithic bypass
C4	10uF electrolytic 16VW
C5,6	47pF disc ceramic
C21	1nF disk ceramic

Semiconductors

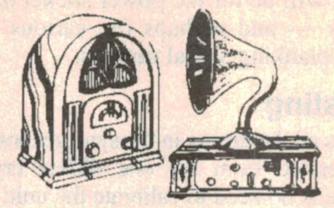
U1,2	74HC161 4-bit synchronous counter
U3,11,16,19	74HC4040 12-bit binary counter
U4	74HC14 hex inverter
U5,18	74HC00 quad NAND gate
U6,12,20	74HC11 triple 3-input AND gate
U7,13,17	74HC08 quad 2-input AND gate
U8	4075 quad 3-input OR gate
U9	74HC390 dual decade ripple counter
U10	74HC4017 decade counter
U14,21	4013 dual D flip flop
U15	74HC32 quad OR gate
D1-4	4001 power diode

Miscellaneous

4MHz crystal; PC board 137 x 123mm, coded 97sg6; 21 PC pins; Tinned copper wire for links.

Vintage Radio

by ROGER JOHNSON



Battery powered valve sets

For various reasons, many of the early valve radio receivers were battery powered. In fact battery powered radios were made in large numbers and have formed an important part of our radio history. This month we're discussing how the battery set evolved, and why they surviving examples should be preserved.

At the risk of stating the obvious, once upon a time all radios were battery powered. Despite the introduction of 'electric' sets from about 1927, battery powered valve radios endured until the mid 1950s, although by then they were available only as portables. During the 1930s and 1940s they were made in large numbers, as mantels, consoles and portables.

There are several reasons for this. Firstly, reticulated 240V AC mains power as we know it today was by no means the norm. Rural properties as close as 50km from the outskirts of Adelaide, and in all probability other capitals as well, still relied upon 32V home lighting plants until the mid 1960s. This is demonstrated by the fact that several television set manufacturers included in their range a model operable from 32V DC.

Secondly, up to the the war years, some country towns and indeed council areas in larger cities, ran on DC mains. Whilst there were radios that were made for DC mains, there were problems with installation, interference and safety. Some consumers opted for the easier option of an all-battery receiver. (Receivers for DC mains will be the subject of a future article).

A.C.
RINGAROOMA, Tas., 240v, 50c, A.C.
RINGWOOD, Vic., 400/230v, 50c. and 460/230v, 50c, A.C.
RIVERTON, S.A., 240v, 50c, A.C.
ROBE, S.A., 220v, D.C.
ROBERTSON, N.S.W., 415/240v, 50c, A.C.
ROBIGANA, Tas., 240v, 50c, A.C.
ROCHESTER, Vic., 400/230v, 50c, A.C.
ROCKDALE, N.S.W., 240v, 50c, A.C.
ROCKHAMPTON, Qld., 415/240v, 50c, A.C.
ROCKINGHAM, S.A., 250v, 40c, A.C.
ROCKINGHAM, W.A., 440/250v, 40c, A.C.
ROCKY CAPE, Tas., 240v, 50c, A.C.
ROLAND, Tas., 240v, 50c, A.C.
ROMA, Qld., 220v, D.C.
ROMSEY, Vic., 400/230v, 50c, and 460/230v, 50c, A.C.
ROOKWOOD, Tas., 240v, 50c, A.C.
SALE, Vic., 400/230v, 50c, and 460/230v, 50c, A.C.
SALISBURY, S.A., 200v, 50c, A.C.
SAMFORD, Qld., 240v, 50c, A.C.
SANDFLY, Tas., 240v, 50c, A.C.
SANDGATE, Qld., 240v, 50c, A.C.
SANDRINGHAM, Vic., 200v, 50c, A.C.
SANDY BEACH, Tas., 240v, 50c, A.C.
SARINA, Qld., 415/240v, 50c, A.C.
SALAMUA, New Guinea, 415/240v, 50c, A.C.
SAMARAI, Papua, 240v, D.C.
SAASAFRAS, Vic., 230v, 50c, A.C.
SCARBOROUGH, N.S.W., 240v, 50c, A.C.
SCONE, N.S.W., 415/240v, 50c, A.C.,
Supply is also provided for Aberdeen.
SCOTSDALE, Tas., 240v, 50c, A.C.
SEAFORD, Vic., 230v, 50c, A.C.
SEA LAKE, Vic., 230v, D.C.
SEFTON, N.S.W., 240v, 50c, A.C.

408

Fig.1: A portion of the listings of mains power throughout Australia in 1938, which shows the diversity of supplies.

Fig.1, taken from the first edition of Volume 2 of the *Australian Official Radio Service Manual*, shows part of the listing of electrical supplies throughout Australia, and serves to illustrate the point.

A third reason was that, for portable radios, there was really no alternative but batteries. And lastly, it seems that it was standard practice that boys and other novices simply *had* to build a one or two valve battery set as part of their introduction into the big time of valve radio!

It must be remembered, too, that certainly up to WW2, not all houses opted for reticulated AC mains power merely because it was available.

Vibrator powered sets, both for automobile and domestic installations, can be classed as 'battery sets', but they are a separate classification in themselves and will be treated as such.

Early developments

Although aspects of the progress of the development of radio has been covered in this and other columns on many previous occasions, it is really necessary to look at the development of the battery set as an alternative to an electric set.

The first all-triode 'coffin box' and 'tin trunk' receivers are quite familiar to many collectors and probably need no further explanation. With the introduction of valves with an indirectly heated cathode, and rectifier valves to provide the HT, the first electric sets were simply the same as their battery operated counterparts; all-triode affairs with two or three neutralised stages of RF amplification, and transformer coupled audio stages with the occasional set having push-pull output.

The Americans introduced the screen grid type UY-224 in about 1928, together with its battery counterpart the UX-222. These valves were used as RF

amplifiers with good effect. The output stage was still commonly a single ended or push-pull low power triode. Valve manufacturers in the UK, and no doubt Europe, followed suit. However, with the development of the more powerful output triodes and pentodes, electrodynamic speakers and large cabinets, the all-electric set was in a class of its own in terms of operating costs and performance, and could not be challenged by battery powered radios.

For example, an all-triode affair using six 201-A's consumed 1.5 amps of 'A' battery current. If you listened to the radio for only four hours per day, a 100Ah accumulator would need charging about every fortnight. The 'B' batteries cost 16/- to 18/- ($1-60 to $1-80) each, or one sixth of an 'average' weekly wages, and two if not three were required. Fortunately, anecdotal stories suggest that these only need replacing every four to six months.

By 1927 Philips, followed by Osram and Cossor amongst other manufacturers, released a whole series of valves which consumed merely 60mA of filament current — thereby contributing markedly to 'A' battery economy. Valve types A609, A615, B409 etc. were typical of these lower consumption types. There are stories of chaps who re-valved their sets with the newer types, and flogged off their 201-A's to new chums, to help defray the cost!

Battery sets were not powerful, were expensive to run and sometimes inconvenient to opereate. So where AC mains power was available, the choice was simple!

The 'Country Man'

Australia's population distribution in the years from 1930 to 1955 was far less urbanised than it is today. This fact, together with the reasons outlined above, meant that battery sets had a very captive audience. Also, by 1932 there were 58 broadcasting stations in the capital and provincial cities, which meant that reliable reception was possible for the farming community.

Despite the Great Depression of the 1930s, there were still plenty of people around with plenty of money. (It has been argued that purchasing power actually increased during the Depression.) Radio manufacturers catered for this market with aplomb, and the 1930-1935 period is one of the most fascinating for battery powered radios.

With the release of new valves such as 230, 232, 234, and a host of European types such as P215, A442, S215, PM 12 etc., the radios at the beginning of this period were very much like their electric counterparts — TRF's with sometimes up to four tuned stages (requiring, incidentally, a four ganged tuning capacitor). Transformer coupled audio stages and triode output were the norm.

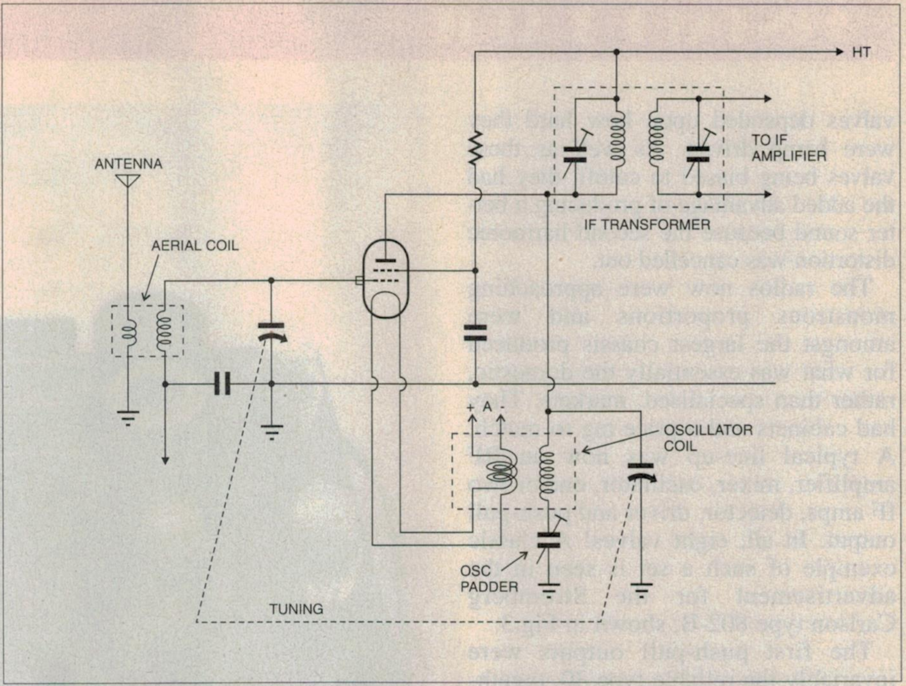


Fig.2: A 'filadyne' autodyne converter circuit. The tickler coils are bifilar wound, so that each side of the cathode is at the same RF potential.

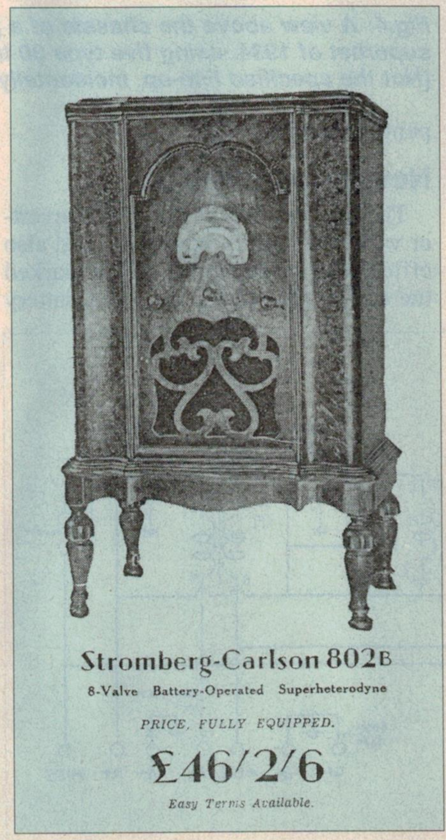


Fig.3: The Stromberg Carlson 802-B, as advertised in Wireless Weekly for May 5th 1933. It was big, bold and expensive.

Battery radios of the time were therefore TRFs with typically four to six valves, and a single ended triode output. The biggest divergence occurred in the 1931/32 period when the autodyne oscillator heralded the re-introduction of the superhet.

Indirectly heated valves, by virtue of their separate cathodes, were readily adaptable to the autodyne circuit, and coupled with the new type 247 pentode output valve, a very good 4/5 receiver was produced which performed well, was both sensitive and selective, and had a reserve of audio power. Such sets abound today amongst collectors.

The 1932-1935 period

The battery RF pentode could be adapted to the autodyne, but required a special and critically wound oscillator coil. An example of the battery autodyne, sometimes called the 'filadyne' is shown in Fig.2. A separate oscillator valve was more often than not included in the design. For country work, conventional wisdom was for a tuned RF stage.

By now the radios had grown. More valves meant more 'B' battery current. A final Class A audio stage, whether triode or pentode, was going to consume more current than was desirable. The answer came with push-pull class B triode output, whereby the current drawn by the

valves depended upon how hard they were being driven. As well as these valves being biased to cutoff, they had the added advantage of producing a better sound because the second harmonic distortion was cancelled out.

The radios now were approaching monstrous proportions and were amongst the largest chassis produced for what was essentially the domestic, rather than specialised, markets. They had cabinets and a price tag to match. A typical line-up was now an RF amplifier, mixer, oscillator, one or two IF amps, detector, driver and push-pull output. In all, eight valves! A classic example of such a set is seen in the advertisement for the Stromberg Carlson type 802-B, shown in Fig.3.

The first push-pull outputs were invariably the reliable type 30, together with a sprinkling of European types such as the A209. In about 1934, and continuing on until WW2, the twin triode type 19 was introduced especially for class B output, followed by its octal equivalent type 1J6-G. The other popular types were KDD2, B240 and PM2B. An above-chassis photograph of the eight-valve 'Tasma' model 150 for 1934 is shown in Fig.4.

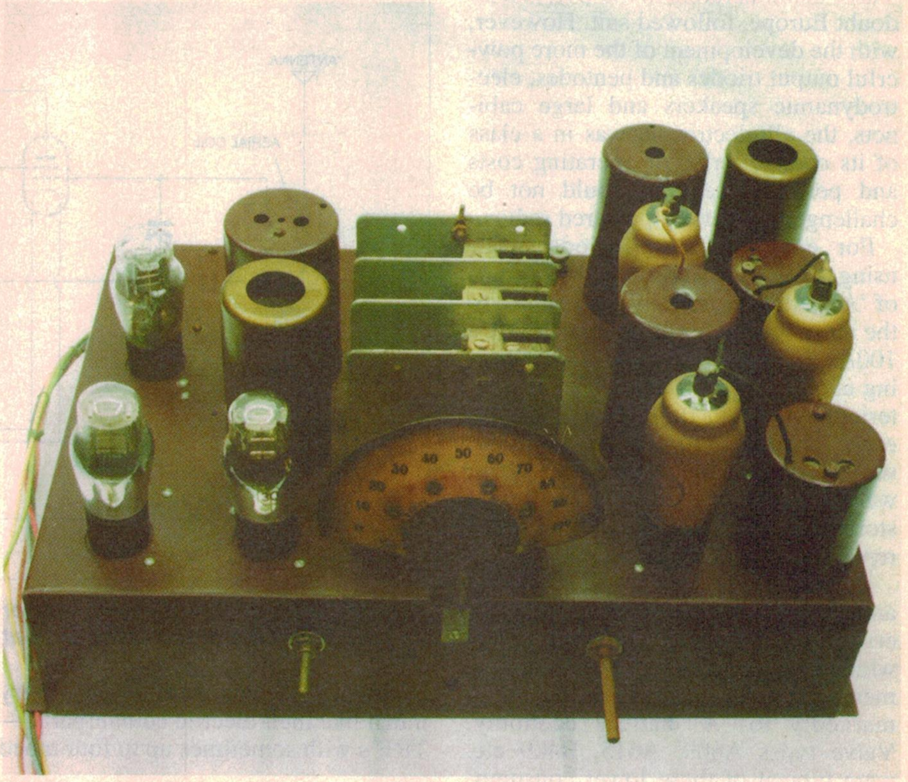


Fig.4: A view above the chassis of a part-restored 'Tasma' eight-valve battery superhet of 1934, using five type 30 triodes and three type B255 RF pentodes. (Not the specified line-up, incidentally.)

It should be added that of course not all battery operated receivers were of this variety. There were many manufacturers producing three and four valve TRFs. A 'Healing' model 33B of 1933 is a classic example, consisting of a type 34 RF amplifier, a type 32 regenerative detector and a type 33 pentode output.

Newer valve types

The introduction of the 1A6 converter valve for battery operation, and also efficient pentode output valves marked the end of the era for the giant battery superhets. The type 33 output valve was introduced in 1933, along with the European types C243N, PM22, PM22A, PM22B, PM24A etc. In 1934 Philips introduced the battery octode type KK2.

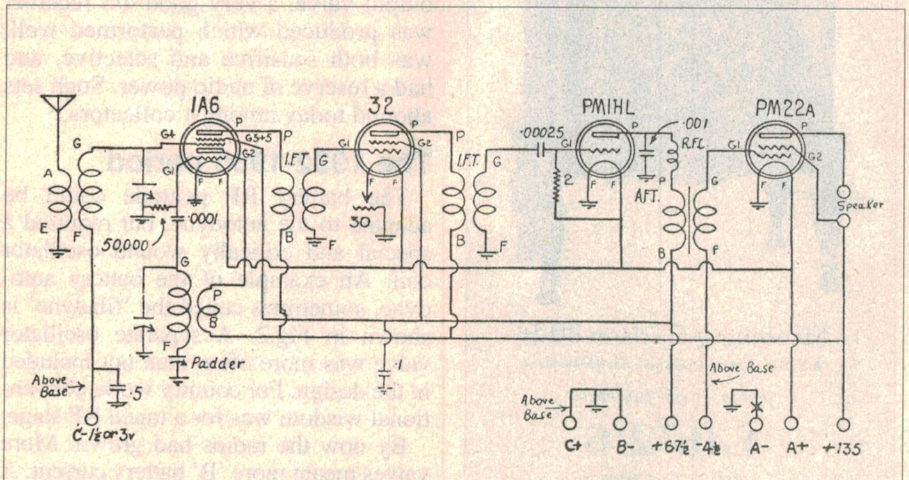


Fig.5: The original 'Pentagrid Four' circuit, as published in the September 28, 1934 issue of Wireless Weekly.

With better coils, and higher gain valves, a four-valve battery superhet was now viable, and this magazine's predecessor *Wireless Weekly* introduced the 'Pentagrid 4' superhet in the issue for May 25th, 1934. The circuit is shown in Fig.5, and contains some anachronisms, such as a filament rheostat, leaky grid detector and a triode transformer coupled audio stage. It was claimed to be the first four-valve battery superhet in Australia.

However the die was cast, and from 1935 onwards, with the release of the Australian designed types 1C6, 1C4, 1K4, 1K6 and 1D4, and several higher gain RF pentodes such as the 1A4-P and KF2 etc., the majority of set manufacturers contended themselves with a standard four-valve superhet lineup. To this basic configuration some sets added an RF amplifier, and occasionally a foray into push-pull class B output.

Philips released their P-based valves, which were used by some manufacturers. Apart from the fiendish bases and metallic coating, the characteristics were pretty similar to the American and Australian counterparts.

The 'Pentagrid' series of battery operated superhets continued with that name until 1950 — but employing the newest minature valve types.

Portable power

Portable sets have been adequately covered on previous occasions. The very earliest of them used small accumulators in glass cases for the 'A' battery, and were not user friendly. The introduction of the 1.4 volt battery operated valves in 1938/9 meant that these sets could operate from 'all dry batteries', and battery manufacturers responded with a line of 'A' and 'B' batteries which had compatible amp-hour capacity — so that they would more-or-less become flat at one and the same time.

Valve portables endured until the mid 1950s, when they frequently had an inbuilt power suply for operating from the 240V AC mains and a dubious circuit for 'regenerating' the dry batteries!

Keeping them alive

One of my reasons for writing about battery sets this month is to try and convince the doubtful that these sets have a proper place in the scheme of things, and to encourage their preservation. Unfortunately, because they are not easily plug-in-able, many have been discarded, stripped for parts or in some way 'converted' to use AC valves with an inbuilt power supply.

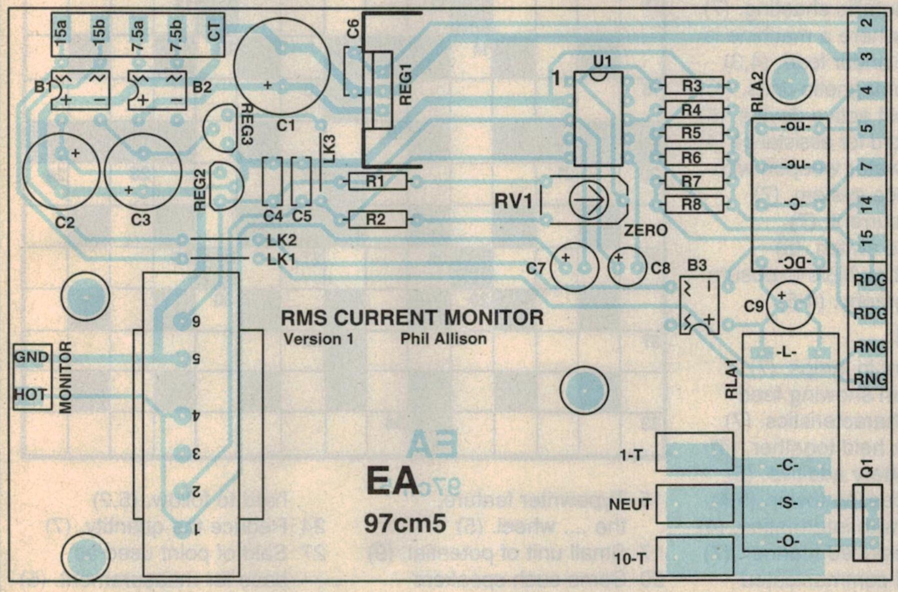
Many collectors, and especially dealers, realise that a radio which cannot be simply plugged into the AC mains is not a saleable item (other than to real enthusiasts), no matter how attractive the cabinet might be. But please do not discard them for this and no other reason.

A universal power supply is all that is required. One has already been described in this column in *EA* for March 1990, and another simplified version which will cater for the many, many surviving 2V/135V battery sets will be described in coming months.

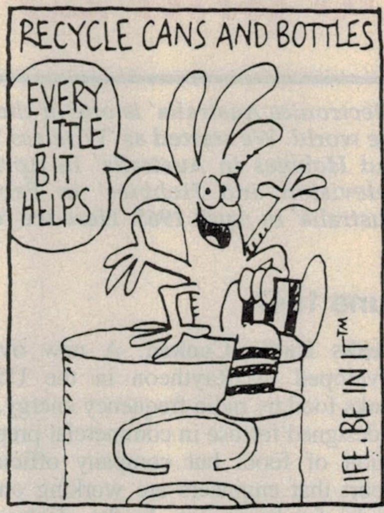
Battery valves are not particularly hard to come by. Many collectors have purchased battery valves in a job lot, and don't know what to do with them! Apart from these two limitations, servicing is no more difficult than their electric counterparts. In fact, lower voltage components, particularly capacitors, are cheaper to purchase than the equivalent value rated at 630V, which are necessary for AC sets.

In closing, battery powered radios formed an important part of our history, and with renewed enthusiasm from collectors, they should take their rightful place amongst our collections. They do, after all, have a fascination all of their own. ❖

NOTES & ERRATA



RMS Current Monitor (May 1997): The 'tracks' information somehow disappeared from the PCB overlay diagram on page 59, during the printing process. The diagram is repeated again here, hopefully intact this time. ❖



READER INFO NO.22

ELECTRONICS AUSTRALIA'S

READER INFORMATION SERVICE

COMPUTER BULLETIN BOARD

As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and rapid downloading by readers equipped with a personal computer and modem. We know that a high proportion of our readers have these facilities, nowadays.

Here's an idea of what's currently available on the BBS:

- Software needed for recent PC-based EA construction projects
- Index files for EA and ETI construction projects
- Recent notes and errata, both published and as-yet unpublished
- Useful public domain and 'shareware' software for electronics and amateur radio applications.
- General interest shareware utilities, such as the commonly-used compression and decompression utilities used for efficient storage and faster file transfer.
- The ability to upload Letters to the Editor, and/or contributions to our Forum and Information Centre columns (send them as plain-text ASCII files, please)
- An on-line 'Discussion Forum' facility, which allows readers to exchange useful technical information directly.

The *Electronics Australia* Reader Information Service BBS is ANSI-compatible and is currently operational for virtually 24 hours each day, seven days a week, on (02) 9353 0627. Your modem can be set to any standard speed from 300 to 28,800b/s full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit).

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

June 1947

Steaks Radio Cooked: A new oven developed by Raytheon in the USA cooks food by radio frequency energy. It is designed for use in commercial preparation of food, but company officials report that engineers are working on a model for home use. In the electronic cooker, radio waves create infra-red radiation which penetrates to the centre of the food, speeding up cooking time. Steaks can be cooked in less than a minute. The Federal Communication Commission of the USA recently authorised a band of frequencies between 2400 and 2500 megacycles for such electronic apparatus.

Two-way Teletype in Aircraft: Teletype methods of communication can now be extended to aircraft in flight, using equipment developed by Teletype Corporation engineers and Bell Telephone Laboratories. Radiotelephone facilities provided for plane to ground communication are used without modification. A converter translates the electrical conditions set up by the teletypewriter keyboard into signals suitable for transmission over the radio telephone channel. When receiving, it translates the signals from the radio channel back into signals suitable for operating a teletypewriter printer.

The converter unit produces an audio frequency signal which modulates the radio transmitter continuously during teletype transmission. The frequency of the audio signal is varied back and forth between the frequencies of 1615 cycles and 1275 cycles, in accordance with the teletype character being transmitted. The unit also automatically conditions the radio equipment for teleprinter operation.

June 1972

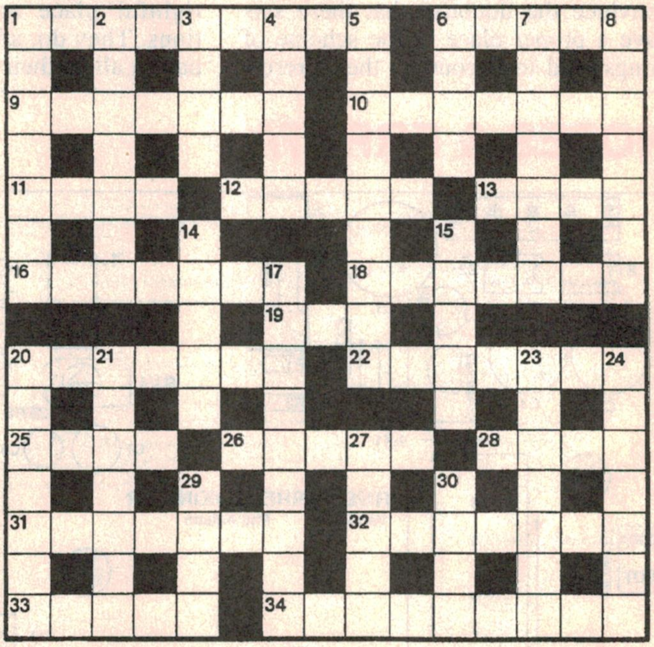
NASA's 210ft Space Antenna near completion at Tidbinbilla: Australia will soon be the only country in the world with two 210ft (64m) space communication antennas. The new antenna at Tidbinbilla has been structurally completed and its electronic components are now being installed.

The 7000-ton antenna is similar to the 210ft NASA antenna at Goldstone, California, which until now has been NASA's only antenna of that size. Another 210ft antenna is presently being built near Madrid, Spain; the three will support inter-planetary missions from 1973 into the 1980s.

NASA has been borrowing the 210ft radio telescope built for CSIRO astronomers at Parkes, NSW for deep space coverage from this hemisphere, and has based the design of the Goldstone antenna an both new antennas on the CSIRO design.

Tidbinbilla's new antenna is as high as a 23-storey building. The shape of its 210ft dish must be maintained within +/- 1/8in of a perfect paraboloid. ❖

EA CROSSWORD



ACROSS

1 Computer case style. (4-5)
6 Energetic intermediate in electricity production. (5)
9 Ask. (7)
10 Remove magnetism. (7)
11 Computer operating system. (4)
12 Fault; mistake. (5)
13 Second given name of Edison. (4)
16 Metallic element with single-letter symbol. (7)
18 Determine components. (7)
19 Instrument landing system (abbr). (1,1,1)
20 Thin metallic sheeting. (7)
22 Place where a machine is trialled under load. (4,3)
25 Electromagnetic units. (4)
26 Simplest active device. (5)
28 Cue word for assistance (4)
31 Underwater weapon with guidance system. (7)
32 Small current. (7)
33 Remote switch. (5)
34 Kind of multiple-exposure photography. (4-5)

DOWN

1 Element in lamps. (7)
2 Diagram showing feed-back characteristics. (7)
3 Joined; held together. (4)
4 Car battery additive. (5)
5 Broadcasting tower. (5,4)
6 Board with information. (4)
7 In a balanced manner. (7)
8 Item of communicated information. (7)
14 Name of tube used in velocity measurement. (5)
15 Typewriter feature, the .... wheel. (5)
17 Small unit of potential. (9)
20 Some such speakers employ PZT. (7)
21 Domestic wiring term. (7)
23 (Of reception) becoming hard to follow. (5,2)
24 Reduce the quantity. (7)
27 Said of point used as base for measurement. (5)
29 Inventor of flare gun for signalling. (4)
30 Face of meter. (4) ❖

SOLUTION TO MAY 1997:

S	E	I	S	M	I	C	■	S	A	M	P	L	E	R
P	■	T	■	I	■	H	■	W	■	E	■	E	■	U
H	E	A	D	P	H	O	N	E	■	L	O	C	K	S
E	■	L	■	S	■	K	■	E	■	T	■	T	■	T
R	A	I	L	■	T	E	M	P	O	■	S	U	H	L
E	■	A	■	S	■	S	■	I	■	D	■	R	■	E
■	I	N	P	U	T	■	I	N	T	E	G	E	R	S
K	■	■	■	I	■	I	■	G	■	C	■	■	■	S
R	E	A	L	T	I	M	E	■	M	A	T	H	S	■
I	■	R	■	E	■	P	■	B	■	Y	■	E	■	E
E	A	S	T	■	T	U	T	O	R	■	T	W	I	N
S	■	E	■	D	■	R	■	O	■	O	■	L	■	T
L	A	N	C	E	■	I	N	T	E	R	F	E	R	E
E	■	I	■	C	■	T	■	E	■	A	■	T	■	R
R	E	C	T	I	F	Y	■	D	E	L	E	T	E	S

Electronics Australia's

Professional Electronics

S U P P L E M E N T

US FIRM TELEDESIC TO SET UP ARRAY OF 800 LOW EARTH ORBITING SATELLITES FOR FAST GLOBAL DATACOMMS

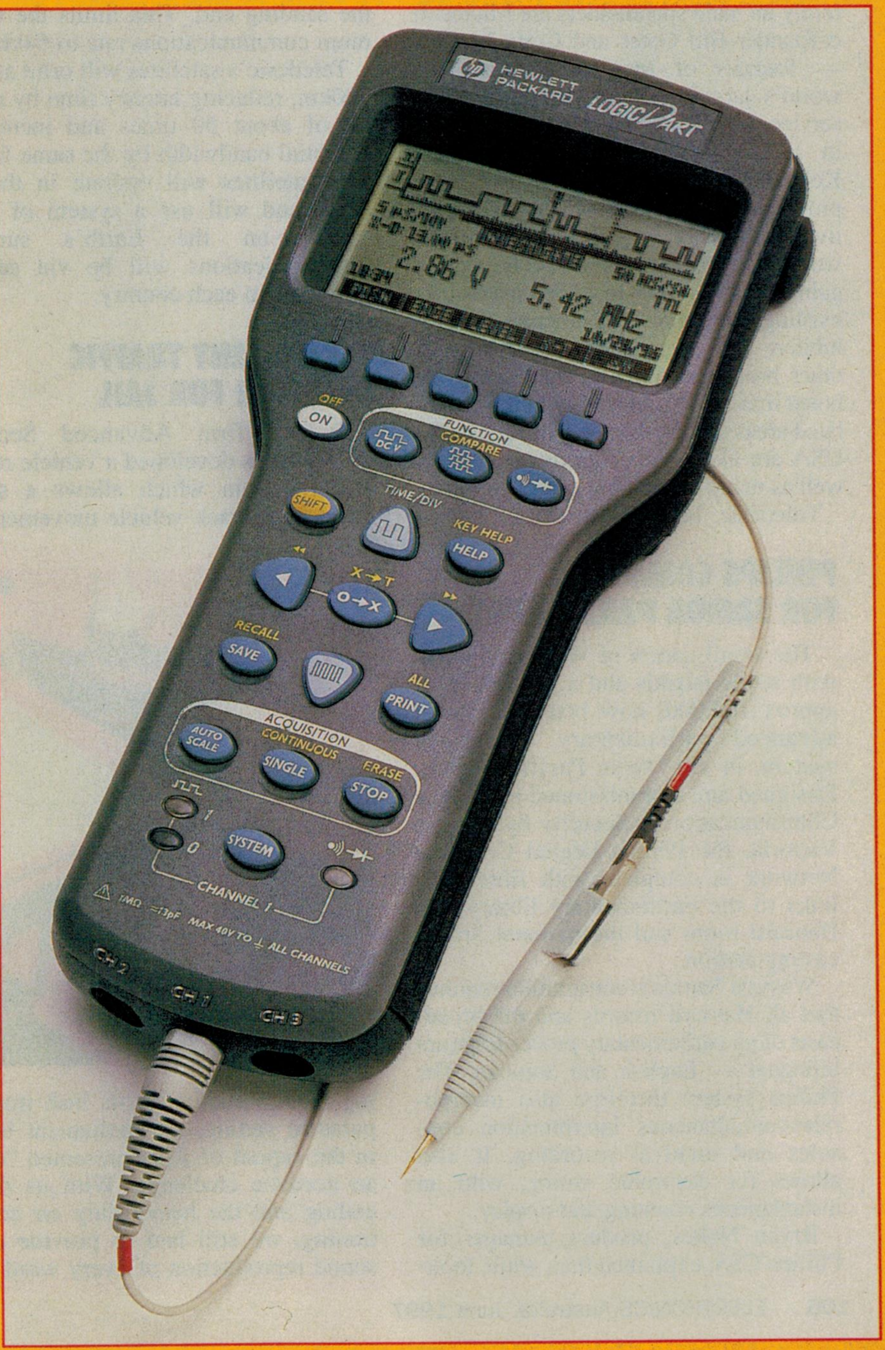
AMERICANS DITCHING CABLE TV FOR DIGITAL SATELLITE

TEENAGER WINS US$40,000 FOR CHIP FAB INVENTION

FEATURE ON THE LATEST TEST & MEASURING INSTRUMENTS

HP'S NEW 'LOGICDART': AN ADVANCED HANDHELD LOGIC PROBE/ANALYSER COMBINING A 100MS/s TIMING ANALYSER, LOGIC MONITOR, DC VOLTMETER AND CONTINUITY TESTER. ITS THREE INDEPENDENT INPUT CHANNELS CAN BE SAMPLED WITH 10ns RESOLUTION, PLUS FLEXIBLE TRIGGERING FACILITIES & MEMORY FOR STORING UP TO 10 WAVEFORMS OF 2048 SAMPLES...

(See T&M Feature)



NEWS HIGHLIGHTS

800 LEO SATELLITE SYSTEM FOR DATACOMMS

A data communications system employing an array of over 800 low-Earth orbiting (LEO) satellites is to be built by US-based Teledesic Corporation, to provide 'next generation' broadband interactive services to users anywhere in the world.

Teledesic was founded in 1990 and currently its main shareholders are Microsoft cofounder Bill Gates and Craig McCaw — founder of McCaw Cellular, the world's largest cellular communications service provider before its sale to AT&T in 1994. Company spokesman Daniel Kohn explained that Teledesic's goal is to provide full access to wideband interactive services for the many people in the world who will not otherwise be able to gain access — due to either inadequate existing telecomm infrastructure, or prohibitive costs in extending fibre-optic or other broadband links to their areas. He noted that many remote and lightly populated areas in developed countries like the USA are likely to be in this position, as well as many developing countries.

Teledesic believes that its planned network of LEO satellites is the only way to provide the satellite equivalent of a fibre-optic link for data communications, because it offers much shorter latency times than geostationary satellites. Due to the 36,000km orbit of geostationary satellites, a data packet takes 250ms to pass between two Earth-based terminals, and with TCP/IP communications another 250ms is spent before the acknowledgement packet arrives back at the sending end. This limits the maximum communications rate to 64kb/s.

Teledesic's satellites will orbit at only 700km, reducing latency time by a factor of about 50 times and increasing potential bandwidth by the same factor. The satellites will operate in the Ka band, and will use a system of fixed 'cells' on the Earth's surface. Communications will be via service providers in each country.

INTELLIGENT TRAFFIC MONITOR FOR JAIL

Sydney firm Advanced Security Systems has developed a vehicle recognition system which allows a single operator to track vehicle movements in and out of Silverwater jail.

The Intelligent Traffic Monitoring System, developed specifically for Silverwater jail using Advanced Security's technical expertise and German developed software, tracks all vehicles entering and leaving the jail by recording the time and date of every vehicle movement in and out of the gates.

Based on optical character recognition (OCR) software, the system identifies number plates on vehicles entering or leaving the jail via video recorded images. It then cross matches the number plates on the system database and alerts the operator if any discrepancies are found.

The system operates independently, freeing guards for other duties. A printed report alerts the operator if a vehicle has been identified as stolen, banned or is not recognised by the system. A daily record produced by the system also gives the operator the ability to track particular vehicles and distinguish how many movements vehicles are making in and out of the site.

The operator can also request information on vehicle movements by logging into the database and specifying a vehicle number plate. The system then

PHILIPS COMMS FOR SAMOA PARLIAMENT

The small nation of Western Samoa, with seven islands and a population of approx 162,000, now boasts the most advanced parliamentary conference system in the Asia Pacific region. Designed and commissioned by Philips Communication & Security Systems in Victoria, the Philips Digital Congress Network is complete with fibre-optic links to the parliamentary library, the Hansard room and the national broadcasting station.

Western Samoa's constitution requires that all Hansard records and the broadcasts of all parliamentary proceedings are bilingual — English and Samoan. The Philips system therefore also incorporates simultaneous interpretation consoles and archival recording. It also allows for electronic voting, with an instantaneous counting and display.

Bryan Nokes, product manager for Philips CSS, explained that, while looking most attractive in its lush tropical paradise setting, the parliament house in the capital of Apia presented "quite an acoustic challenge. With its dome ceiling and the heavy duty air conditioning, we still had to provide clear sound reproduction of every word in a parliamentary debate. This we fixed, and every one of the 56 desk consoles has a built-in loudspeaker," said Bryan.

The new system is an AusAid gift from Australia, and replaces an older Philips system installed when the parliament house was built.

Extending cellular phone coverage within shopping complexes and other buildings can require specialised treatment. US-based Andrew Corporation makes this amp/antenna kit for such applications.

searches for all recent movements made by that vehicle.

'ELECTRONICS AT WORK' SHOW FOR MELBOURNE

Australia's leading electronics suppliers and manufacturers will be exhibiting their wares at this years' Electronics At Work exhibition, to be held in Melbourne in June. This is claimed to be the only exhibition dedicated entirely to electronics, and provides electronic engineers nationwide with the opportunity to see state-of-the-art electronic products and components without having to travel overseas.

"The inaugural event, held in Sydney last year, proved to be an outstanding success and a significant number of exhibitors have rebooked for this year, plus many new companies are also booking space. It is clear that the industry really wanted a dedicated electronics event here in Australia," said Ms Debbie Cadet, the Exhibition Manager.

The Electronics At Work expo is strengthened considerably by a conference and workshops that are run in conjunction with the exhibition, presented by the Australian Electronics Development Centre (AEDC). This year they have been designed to impart the most up-to-date industry information and to highlight the current industry 'hot topics': EMC (Electromagnetic Compatibility), PCB design, software quality and automated soldering techniques. Local and overseas guest speakers will provide attendees with the latest in software and hardware design and manufacturing.

Electronics at Work will run over four days, from 16 - 19 June at the Melbourne Convention Centre (formerly the World Congress Centre). For more information contact Debbie Cadet at Practical Marketing on (02) 9958 1811, or fax (02) 9958 2579 (e-mail **pracmac@ozemail.com.au**).

S-A'S FIRST GATEWAY TERMINALS FOR IRIDIUM

Scientific-Atlanta engineers have delivered three earth terminals that form the first satellite communications gateway for the Iridium global communications system. The gateway, installed in Tempe, Arizona, will undergo further integration and test activities before completion in June.

Iridium is a worldwide wireless telecommunications network being designed to provide telephone, paging, facsimile, and data services to registered subscribers using handheld telephones and pagers. Worldwide commercial service availability is planned for late 1998, when the entire 66-satellite LEO network is scheduled to be operational.

Scientific-Atlanta's Communications and Tracking Systems Division is under contract to build 57 earth terminals for the Iridium network. Of these earth terminals 43 will be used in communications gateways and 14 will be used in the system control segment that regulates the orbit of the Iridium satellites.

System control segment earth terminals have already been installed at ground sites in Iceland, Canada, and Hawaii, as well as the testing site in Chandler, Arizona.

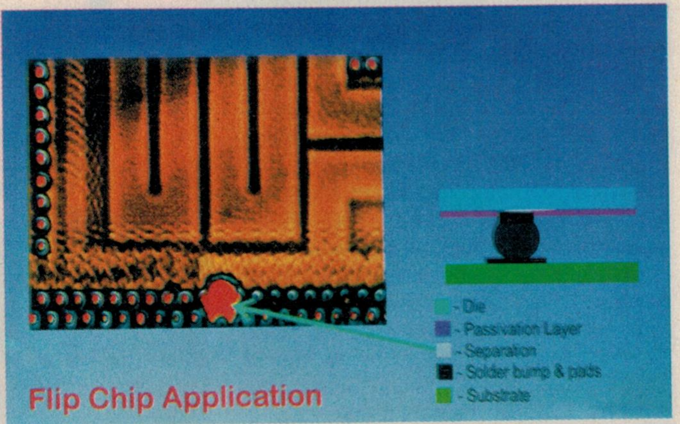
The communications gateway terminals comprise a 3m dish inside a 5m radome, and provide the communications link via Ka-band (19.4-19.6GHz for downlinks, 29.1-29.3GHz for uplinks) between the Iridium satellites and public-switched telephone networks.

TELSTRA CABLE NETWORK USING PIRELLI PHOTONICS

Following a successful 1996 trial, Pirelli Cables Australia's photonics amplifiers will be deployed by Telstra in its cable TV network to boost television transmission over long distances. This is said to be the first use of optical amplifiers in the cable TV network and is expected to at least double the transmission distance of the broadcast signal. The Pirelli 1550nm system will be supplied to Telstra via their prime vendor Philips Electronics Australia Limited.

Pirelli's photonics transmitters, line amplifiers and fibre-optic cable are key components of its pay TV system, developed by the Australian Photonics Business Centre. By replacing traditional electrical-to-optical repeater equipment with Pirelli's optical amplifiers, longer links can be achieved with better quality, avoiding the need for intermediate ampli-

US firm Sonoscan has extended its ultrasonic imaging system to allow detailed nondestructive inspection of ICs using the 'flip chip' mounting system. It scans the chips with acoustic waves at 180MHz.



NEWS HIGHLIGHTS

fication and reducing the need for multiple sets of Head End equipment.

According to Pirelli Communications System's General Manager Mr Massimo Mariani, the deal represents another important step in the repositioning of the company from cable manufacturers to high technology telecommunications network system providers.

"We believe our cable TV system is the strongest, most innovative and cost effective available in the industry."

QLD GOVT PROVIDES 180 GRAPHIC SCHOLARSHIPS

Queensland's Government is making available 180 scholarships, with a total value of approximately $2 million, at the soon to be opened Silicon Studio Training Centre (SSTC) in Brisbane. Small Business and Industry Minister Bruce Davidson said the scholarships had been funded by the Coalition Government as part of its commitment to establishing Queensland as a world centre for excellence in the information technology and media industries.

"The Silicon Studio Training Centre, which will be only the third of its type in the world, puts Queensland at the very forefront of training in the application of digital technology to film, television and mulitimedia," he said. "Students will use some of the most sophisticated computer technology developed by the US based Silicon Graphics, to create leading edge multimedia effects and animation as seen in movies such as *Jurassic Park* and *Toy Story*."

"Through these scholarships, and training facility, we will offer Queenslanders skills unmatched in Australia and the Asia-Pacific region. Only two other Silicon Studio Training Centres exist in the world, in Soho, London and Santa Monica, California."

The Training Centre is also expected to attract paying students from around Australia, New Zealand and south-east Asia.

US VIEWERS DITCH CABLE FOR SATELLITE

According to a national survey released by the US Consumer Electronics Manufacturers Association (CEMA), Direct-to-Home (DTH) satellite systems are drawing more than a million US subscribers a year away from cable, and enabling another 322,000 households to downgrade their cable options to just 'basic' service. CEMA estimated the growing consumer preference for DTH over cable now results in a US$1.4 billion annual revenue loss to the US cable industry.

"The primary reasons consumers are opting for Digital Satellite System (DSS) and other DTH systems, over cable are the satellite systems' superior picture and sound quality and the availability of a greater number of channels," said Gary Shapiro, CEMA president.

Specifically, in the national survey of a random sample of 1000 DSS owners, 92% said one of the reasons they purchased the mini-dish satellite equipment was to have access to more channels and a greater variety of programming. In addition, 87% said they purchased DSS to improve the picture quality available on their home entertainment systems, and 69% also cited the satellite system's enhanced audio capabilities.

DSS hardware includes a mini-dish about 18" in diameter and decoding equipment that allow families to receive an array of sports, movies and other programming in digital form transmitted directly from a satellite to their homes. DSS was introduced in 1994 and rapidly gained wide spread consumer acceptance. More than one million units were sold in its first year of introduction, making DSS the fastest selling US consumer electronics product ever.

According to CEMA, more than 2.2 million DTH systems were installed in 1995 and 3.5 million in 1996. The Association estimates that 4.4 million systems will be purchased in 1997. Prices for DSS hardware, specifically, have dropped significantly since their introduction and today can cost as little as US$199 when purchased with a subscription to one of the programming services.

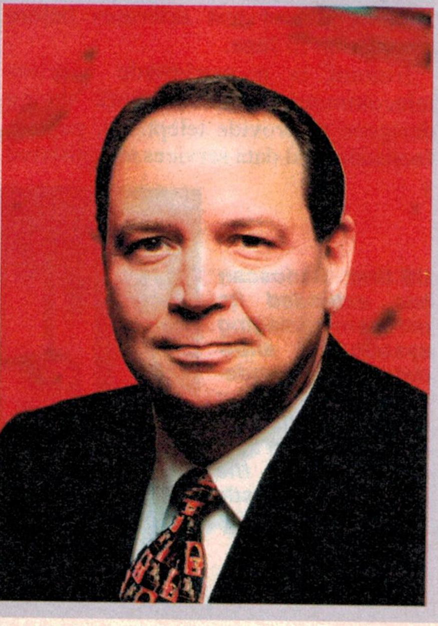
Some 60% of the DSS owners who subscribed to cable said the poor quality of the cable services was the most important reason they purchased a satellite system. And, after installing the systems, 64% of

US SECURITY MOGUL ENTERS AUST MARKET

The Australasian electronic security systems industry may be set for a shake-up, with the entry of one of the world's most successful and innovative players.

Signature Security Group, headed by former White House Secret Service agent Jim Covert, has acquired Securitas Alarms, the electronic installation, monitoring and service division of Australian publicly listed Tempo Services Ltd. Securitas is among the market leaders in electronic security systems, with offices in major cities throughout Australia.

Mr Covert, who previously built one of the world's largest electronic security systems companies as president of US-based SecurityLink, says he plans to mould Securitas into the dominant force in the local market over the next few years.



Mr Covert said there was huge growth potential for the security systems industry in Australia. Signature intended to introduce many of the marketing and management innovations which had seen his previous business, SecurityLink, grow from a two-person operation in the US to the third largest electronic security systems company in the world over an eight-year period.

"The percentage of homes and businesses in Australia and New Zealand with electronic security systems installed is only a tiny fraction of that in the US," he said. "However, the burglary rate here is actually double the US figure. We intend to make a dramatic change in the way people view their security needs by giving them the ability to protect their home or business with state-of-the-art systems and pricing plans that make them easier to install."

AMTEX ELECTRONICS CELEBRATES 18 YEARS

Established by engineer Jim Kuswadi in 1979 as a one-man business, Amtex Electronics recently celebrated its 18th birthday.

The product focus in the early years was photovoltaics — electricity from the sun. Over the years however, the product mix changed and now Amtex has two divisions: Power Supplies under Peter Mitso, and Displays and Systems under Peter McBride.

The company has also grown from a purely importing and distribution business to providing custom engineering solutions. An Engineering department was started two years ago and Amtex can now offer solutions specially tailored to customer requirements. Typical examples include large power supply systems for the Tasmanian Hydro Electric Commission, power systems for the Jindalee over-the-horizon radar project, rugged panel mount computers for the mobile air traffic control towers for the RAAF, and display systems for Queensland Rail.

A few months ago Amtex moved to their new purpose built head office at 2A Angas Street, Meadowbank 2114. Their new phone number is (02) 9809 5022, fax (02) 9809 5077 (e-mail at **Sales@Amtex.com.au**).

DSS owners who previously subscribed to cable dropped cable service entirely.

"It's little wonder cable executives call direct broadcast satellites 'death stars'," Shapiro observed. "DSS is drawing cable's most valued subscribers with a combination of incredible digital picture and sound quality, program choices and other features cable is simply unable to match."

DSTO DEVELOPING SUB DETECTOR

A Defence Science & Technology Organisation scientist will use technology more commonly associated with the mining industry in an attempt to develop a new method of detecting submarines. Dr Julian Vrbancich, a senior research scientist with DSTO's Maritime Operations Division, will carry out his research under a Royal Australian Navy Science Scholarship at the Cooperative Research Centre for Australian Mineral Exploration Technologies at Macquarie University.

Dr Vrbancich's research is based on the observation that the conductivity contrast between metallic objects such as submarines, mines and the surrounding seawater cannot be suppressed or disguised. Therefore, electromagnetic reconnaissance based on 'conductivity contrast detection' has potential to become a very powerful means of surveillance, particularly in shallow coastal waters where passive sonar may have limited performance.

The technique involves generating a magnetic pulse in the area being searched, then observing the secondary magnetic fields created by the pulse. A similar technique is used in electromagnetic geophysical surveys. Dr Vrbancich hopes to use a geophysical survey aircraft and a RAN submarine to gather data during his research.

Dr Vrbancich has worked with DSTO since 1984, and established research in Australia on extremely low frequency electromagnetic (ELFE) emissions. His research in this field led to development of associated naval applications.

UPGRADE FOR BERKELEY SUPERCOMPUTER

The US National Energy Research Scientific Computing Center (NERSC) has signed an agreement with Cray Research to create the most powerful unclassified computing centre in the country. The agreement calls for upgrading NERSC's 160-processor CRAY T3E supercomputer to a 512-processor T3E-900 model.

Located at Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) in California, NERSC is home to five other CRAY supercomputers and will have a combined computational capacity of 500 gigaflops (a gigaflop is one billion calculations per second) once the new machine goes online next summer.

"Since NERSC was moved to Berkeley Lab last year, our goal has been to provide the highest performance computing capability to our users in order to enable scientific discovery," said NERSC Director Horst Simon. "With the T3E-900 coming on line, we'll not only achieve that mission, but we'll continue to help define the future shape of scientific computing."

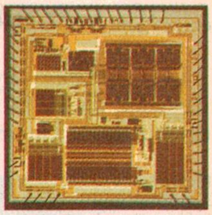
In conjunction with the announcement about the new machine, Berkeley Lab also completed formal acceptance of the 160-processor T3E computer. The total cost of purchasing the CRAY T3E supercomputer and upgrading it to a '900' is $24 million. ❖

NEWS BRIEFS

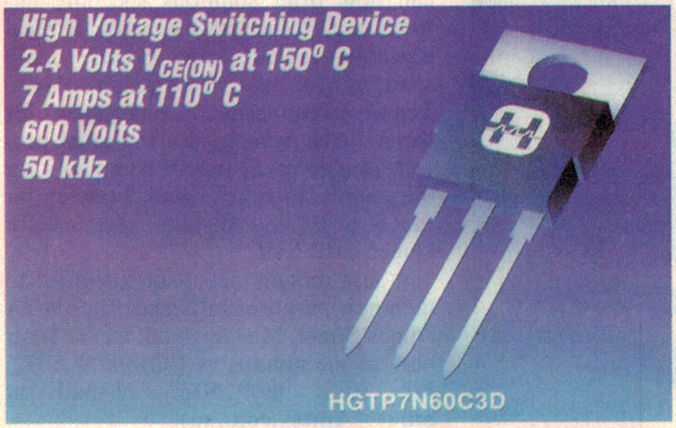
- The AES 14th international conference ***Internetaudio.aes.org*** will be held in Seattle, Washington, June 13-15, 1997. For registration and details check the conference Internet site at **http://internetaudio.aes.org**.
- Analog Devices has appointed ***BBS Electronics*** as an Australian distributor of its full range of electronic components.
- ***SMPTE '97***, the Society of Motion Pictures and Television Engineers Exhibition and Conference will be held at the Sydney Convention and Exhibition Centre, Darling Harbour, July 1-4, 1997.
- ***TDK*** has announced the appointment of Brett Campbell as National Business Manager, Commercial Products. ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY...



IGBT challenges MOSFET



Harris Semiconductor has released the HGTPTN60C3, an ultrafast switching (UFS) IGBT with a current capability of 14A (at 25°C) or 7A (at 110°C) at a voltage rating of 600V. Guaranteed maximum fall time is 275ns.

The device is claimed to be able to switch higher value currents at 50kHz to 100kHz than more expensive MOSFETs. Applications for the device include line-voltage switching power supplies and low power motor control. Switching supply end uses include PCs, home entertainment systems, and small uninterruptible power supplies. Motor control end uses include power tools and small appliances. Versions are available with or without internal hyperfast anti-parallel diodes.

For further information circle 271 on the reader service coupon or contact BBS Electronics Australia, Unit 24, 5-7 Anella Avenue, Castle Hill 2154; phone (02) 9894 5244.

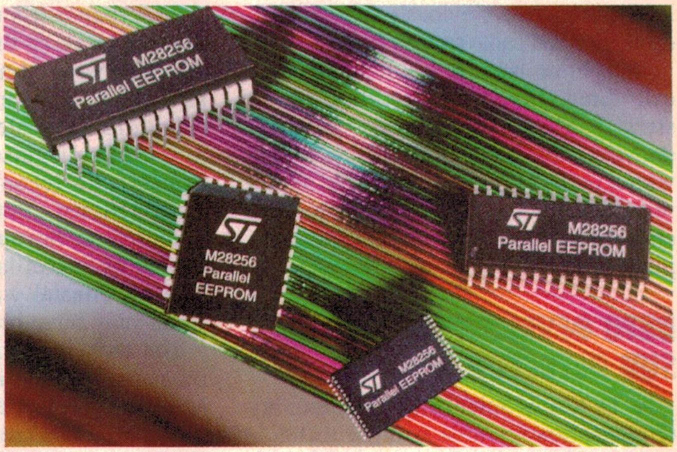
256K EEPROMs with parallel access

SGS-Thomson Microelectronics has introduced the M28256 and the low voltage M28256-W, both 256Kb EEPROMs. Organised as 32K x 8, these devices are based on a proprietary new technology that allows a substantially smaller cell size.

The high density of the device makes it suitable for applications that include portable telephones, programmable controllers, industrial automation equipment, robotics systems and similar applications where a large amount of flexible, non-volatile memory is needed for storing frequently changing system or user data. The IC operates from a single 5V power supply (3V for the M28256-W) and is initially available with a typical access time of 150ns, with higher speed versions to be offered later.

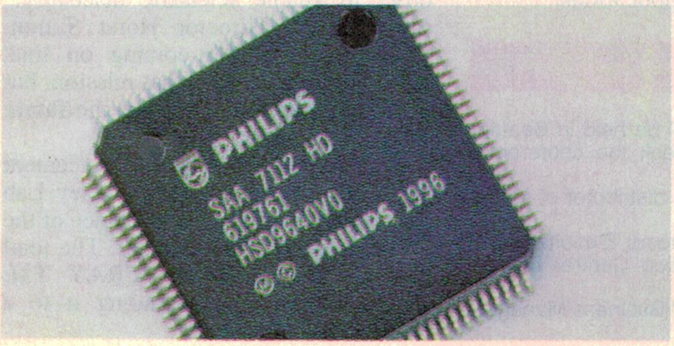
Other features include a guaranteed erase/write endurance of 100k cycles and comprehensive software data protection facilities to prevent spurious data writes.

For further information circle 272 on the reader service coupon or contact SGS-Thomson Microelectronics, Suite 3, Level 7, 43 Bridge Street Hurstville 2220; phone (02) 9580 3811.



Video capture IC

Philips has released the SAA7112, a single-chip video capture front-end IC that connects directly to a VGA graphics controller. It provides glueless capture of video data at the image port of a VGA/VGC controller, and suits applications such as video conferencing, image and text processing.



The SAA7112 can decode NTSC, PAL and SECAM signals, and features high-performance 3D scaling, an image port interface and a digital video expansion port. The video image port interfaces directly to the majority of VGA controllers and can be configured to support a variety of setups. The bi-directional half duplex video expansion port can output real-time decoded YUV data, or accept a second video stream as an input directly to the scaler (from an MPEG decoder or video phone CODEC).

The IC decodes NTSC, PAL and SECAM signals and their respective substandards to CCIR-601 colour component values, using Philips' line-locked clock decoding. This is claimed to ensure excellent picture quality of even weak and distorted signals, such as the output of a VCR.

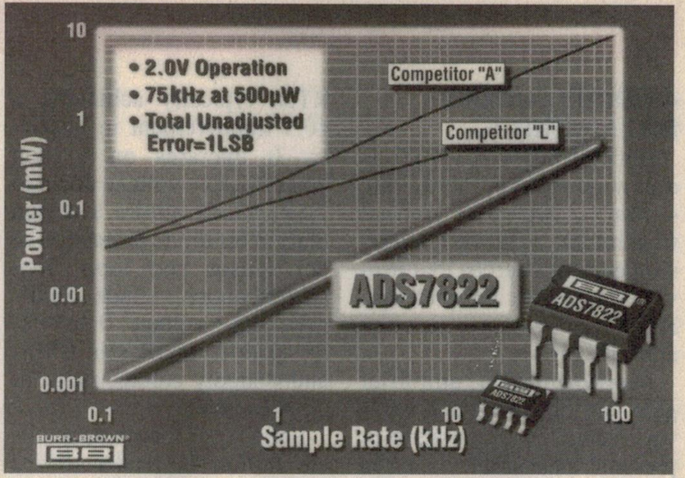
For further information circle 274 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 9805 4479. Web address is **http:/www.semiconductors.philips.com**.

12-bit, 2.7V low power sampling A/D

Burr-Brown's new ADS7822 is a 12-bit, 2.7V, 75kHz sampling A/D converter with a power consumption of 500uW. It is packaged in a compact 8-lead SOIC and is suitable for a wide range of general purpose applications including medical instruments, instrumentation and control systems, and isolated data acquisition systems.

The device is also suited for battery operated systems. It includes a power-down feature between conversions, and on power-up it provides valid data on the first conversion with no clock delay and no waiting for valid data. Supply voltage is 2V to 5V, and the device has a synchronous serial interface and a differential input.

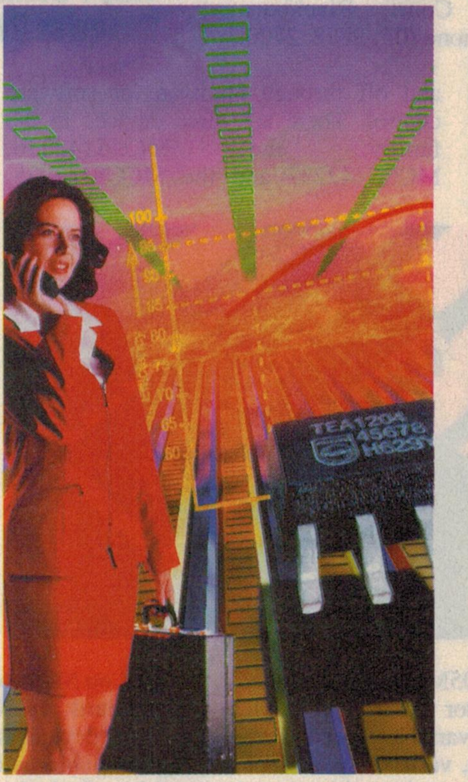
For further information circle 276 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.



DC/DC converter IC is 95% efficient

Philips has introduced the TEA1204t, a low-voltage DC/DC converter with a peak output power of 8W and a conversion efficiency greater than 95%. Targeted for use in cordless and cellular telephones, the single-chip DC/DC converter is said to extend standby and talk times by making better use of the battery energy, even when the battery is approaching complete discharge.

The IC can up-convert the output of a two or three cell NiCd/NiMH battery pack or a single cell Li-Ion battery pack to 3.3V or 5V, or down-convert from 4.8V to 3.6V or 3.3V. Closed-loop output regulation using pulse width and pulse frequency modulation maintains a high conversion efficiency under all load conditions, and enables the converter to respond rapidly to sudden load changes. It requires two low-value reservoir capacitors, a small inductor and a medium power Schottky diode.



For further information circle 277 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 9805 4479.

Fastest slewing op-amp in the West

Analog Devices has released the AD8009, claimed as the fastest slewing monolithic op-amp yet produced. The current-feedback device achieves a slew rate of 5500V/us, more than twice its nearest competitor, with rise and fall times 10% faster at 725ps for a 4V step.

As a simple gain stage or buffer amplifier in high frequency instrumentation, or in high speed test gear (i.e., as a pulse amplifier), the AD8009 is claimed to outperform all other devices. At unity gain it provides a bandwidth of 1GHz (-3dB), falling to 700MHz for a gain of two.

For further information circle 281 on the reader service card or contact Analog Devices, PO Box 98, West Rosebud 3940; phone (059) 86 7755.

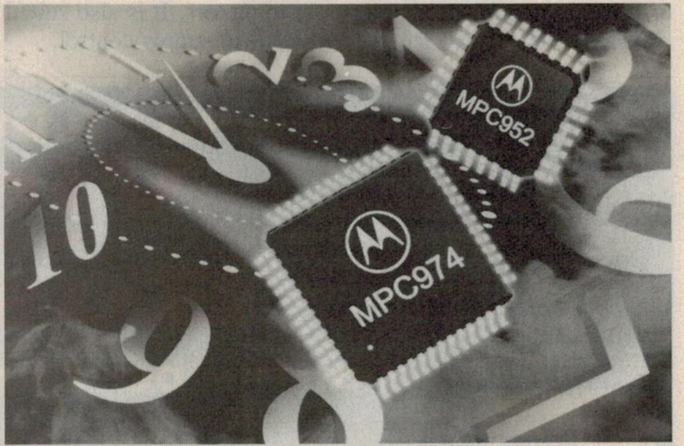
PLL clock driver ICs

Motorola has released a new family of low voltage PLL-based clock drivers, for general purpose clock generation and clock distribution applications. The family is based on a high performance BiCMOS process and can support the clocking requirements of the PowerPC, Pentium Pro and other high performance RISC microprocessors.

The family includes a mixture of LVCMOS and LVPECL I/O devices, with some devices optimised for clock generation and others configured for use as zero delay buffers. All devices are general purpose and include a wide array of programmable features.

The LVCMOS devices have an output frequency up to 150MHz for generating clock signals to support bus speeds from 33MHz to 120MHz. The LVPECL devices support LVPECL I/O levels at frequencies up to 400MHz. The devices operate from 3.3V and feature fully integrated phase locked loops.

For further information circle 279 on the reader service



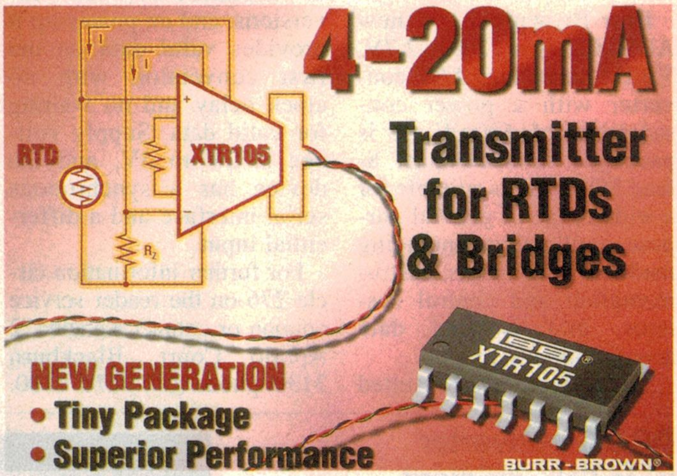
coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 9887 0711.

4-20mA current transmitter IC

Burr-Brown's XTR105 is a new generation monolithic 4-20mA, two wire current transmitter with two precision current sources that provide excitation for platinum RTD temperature sensors and bridges.

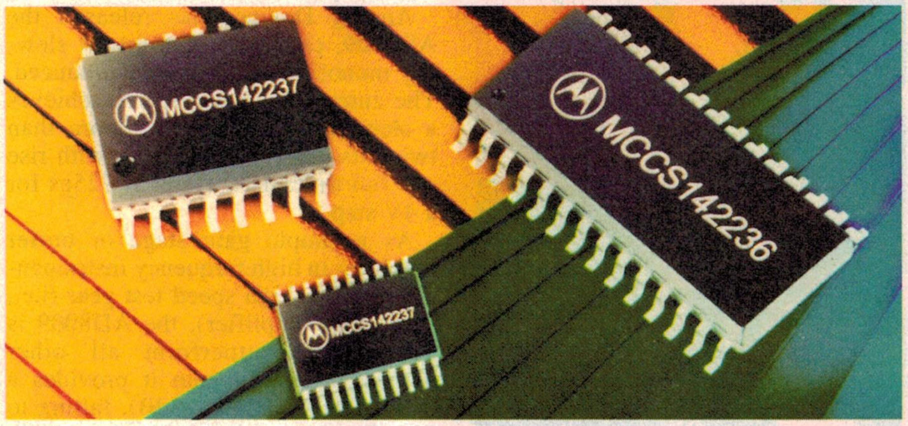
Instrumentation amplifier gain can be configured for a wide range of temperature or pressure measurements, often without adjustment. Its linearisation circuitry provides 2nd-order correction to the RTD, typically achieving a 40:1 improvement in linearity. It operates on a loop power supply voltage down to 7.5V, which allows a design margin for diode protection of the sensor and loop. Key specifications include 100uV max offset voltage, 0.4uV/°C offset drift, 86dB min CMR, and a supply voltage range of 7.5V to 36V.

For further information circle 280 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.



SCSI terminator IC

Motorola has introduced the MCCS14xxxx family of SCSI terminators, in which termination is turned on and off through hardware or software control. There are three devices in the family: the MCCS142236, MCCS142237 and the MCCS142238, which all feature active negation support and low disconnect capacitance.



The MCCS142236 and MCCS142238 terminators have 18 switchable 110Ω terminating resistors, with a typical 4pF disconnect capacitance, and an on-board 2.85V regulator with current sinking capability (active negation support). The MCCS142237 terminator has nine switchable 110Ω terminating resistors, with a typical 3pF disconnect capacitance. The devices suit any SCSI bus application, including optical and hard disk drives, bar code readers, image scanners, CD-ROMs, printers or any peripherals that need SCSI termination.

For further information circle 275 on the reader service coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 9887 0711.

New 68HC05 with PWM module

Motorola has added a new version to its 68HC05 family of 8-bit microcontroller units (MCUs). The new device, the 68HC705MC4, is designed for motor control in appliances (variable speed compressors, variable speed fans, washing machine drives) and servo motors. It is also suited for power supply control.

Based on Motorola's industry-standard 68HC05 core, the new device is one-time programmable and features an 8-bit, dual channel, high speed pulse width modulator (PWM) that includes a software programmable commutation multiplexer for brushless permanent magnet motor control. Additional features include an 8-bit A/D converter for analog feedback signals, and a serial communica-

tions interface to support multicontroller networking.

The microcontroller also includes two timers that can monitor feedback and generate real-time interrupts and timed pulses.

For further information circle 273 on the reader service coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 9887 0711.

18-bit stereo CODEC with serial interface

The new PCM3000/3001 from Burr-Brown is a serial interface stereo audio CODEC (A/D and D/A converter) with single-ended analog voltage input and output. The ADC core has delta-sigma modulation with 64x oversampling, a digital decimation filter, and a high-pass filter. The DAC core has a multilevel delta-sigma architecture which includes an 8X oversampling digital interpolation filter, digital attenuation, de-emphasis, infinite zero detection, and soft mute to form a complete subsystem.

Applications include sampling keyboards, digital mixers, surround sound processors, MiniDisc recorders, DSP-based car stereo systems, DAT recorders and video conferencing. The device accepts 16 or 18-bit data in left or right justified, I^2S, or DSP formats.

The PCM3000 is bit mapped with a three-wire serial interface for special features and data formats, and the PCM3001 is pin programmed for data formats. Specifications include a dynamic range of 94dB (ADC) and 96dB (DAC), single +5V supply, and multiple sampling rates.

For further information circle 278 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700. ❖

ELT 01 – 000 FLU ELT 02 – 000 FLU 5,6.7'97

FLUKE'S 123 INDUSTRIAL SCOPEMETER

It's rugged, it's easy to use, and you wouldn't have any qualms about stuffing it in your bag along with your other tools. Considering that Fluke's new Industrial ScopeMeter costs under $2000 you couldn't do much better — especially out in the field.

by GRAHAM CATTLEY

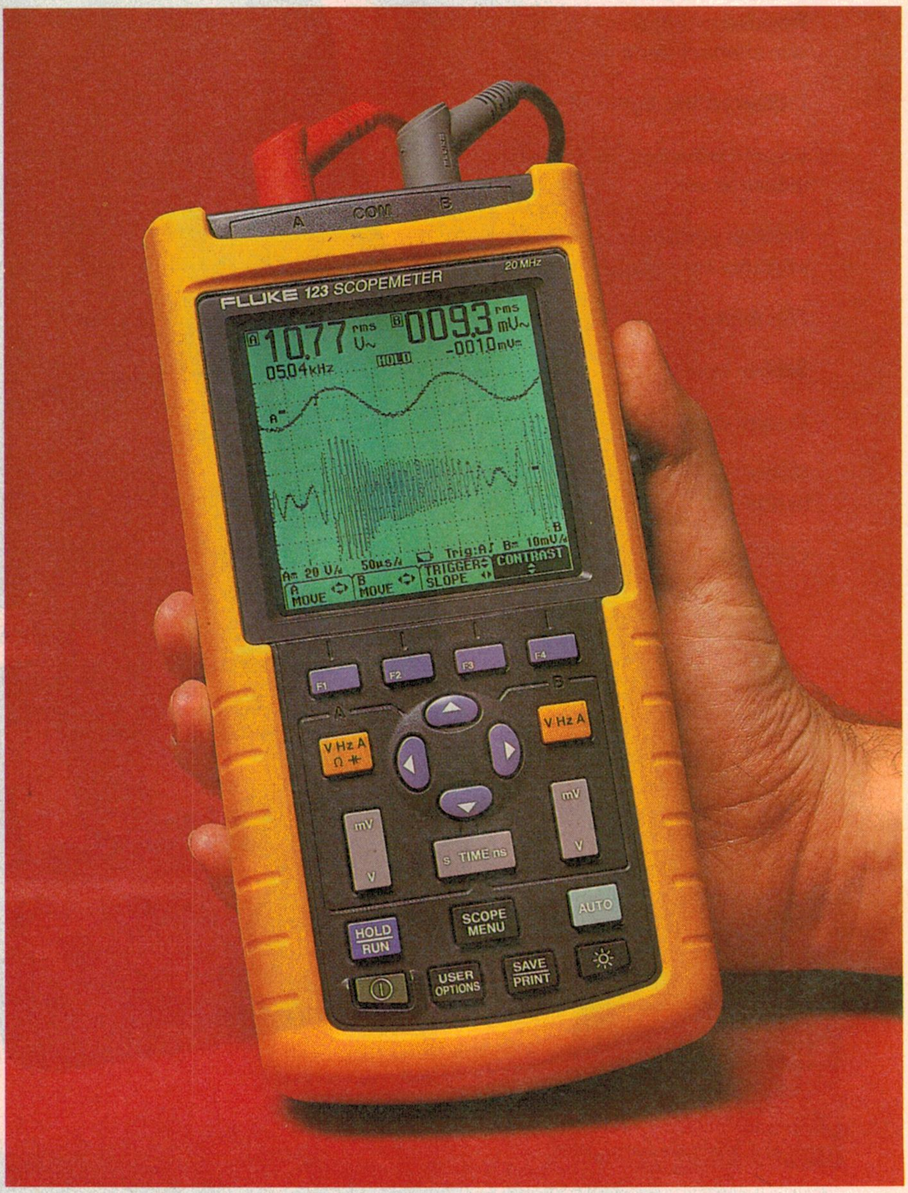
Although test equipment seems to be getting smaller, better and easier to use, in a lot of cases this can amount to overkill. Often you just don't *need* high spec equipment in day-to-day use, particularly for service and repair out in the field. This is where Fluke's latest handheld scope comes in. Small, light and above all completely automatic, the Fluke 123 industrial ScopeMeter has been designed with the service technician very much in mind.

Two things strike you when you first pick up this ScopeMeter. First, it weighs roughly half as much as other handheld scopes; and second, it looks more like an overgrown digital multimeter than a traditional oscilloscope.

The Fluke 123 Industrial ScopeMeter is in fact a dual 20MHz digital scope that has been designed specifically for use in industrial environments. Its hard rubber exterior and toughened scratch-proof screen show that it was built for use out in the field, rather than at home in the lab.

As you can see from the table, the 123 is much more than just an oscilloscope. Large 10mm digits displayed below each input provide 5000-count readings on a huge array of measurements — including the more usual voltage, current and resistance, as well as frequency, capacitance phase and duty cycle.

But there's one overriding feature of the Fluke 123 ScopeMeter that makes this scope different from almost any other handheld scope on the market, and it's something that Fluke call Connect-and-View. While this may sound like yet another trite marketing term, it actually refers to an extremely intelligent autoranging and triggering system. With this system in place, you can perform a multitude of measurements on a piece of equipment — from its mains input all the way through to a digital output — without touching a button. At every stage, the scope automatically sets itself up to give you the complete view of the applied waveform.



Don't confuse Connect-and-View with simple autoranging, however, because behind the scenes a very sophisticated custom chipset is hard at work analysing the incoming waveform. Using Connect-and-View, you can test almost any signal within the scope's capabilities, and it will not only automatically adjust the timebase and amplitude settings, but look for a recurring pattern within the waveform and trigger on every re-occurrence of that pattern (down to a respectable 1Hz cycle time).

So waveforms that are traditionally difficult to view (such as PWM motor drive signals) are displayed as a stable

Specifications

Oscilloscope functions	
Frequency response	DC to 20MHz (12.5MHz with supplied leads)
Input impedance	1MΩ/12pF
Sampling rate	Real time: 25MS/s (up to 1.25GS/s for repetitive signals)
Horizontal range	1us to 5s/div (real time) 20ns to 500ns/div (repetitive)
Sampling resolution	8 bits
Video triggering	PAL, PAL+, NTSC, SECAM
Meter functions	
VAC, VDC, V (AC+DC)	0.5/5/50/500/1250V
Ohms	500Ω to 30MΩ
Capacitance	50nF to 500uF +/-2%
Decibels	0dBV = 1V, 0dBm (600Ω/50Ω) = 1mW on all voltage scales
Relative Phase	(A to B, B to A) 0 to 359°

view of *one complete modulation cycle* — quite impressive.

Surprisingly, Fluke don't seem to promote this rather important feature, with only a few references here and there in the accompanying manual; I get the feeling that they're worried about scaring off potential buyers, with too much technical information...

This isn't necessarily a bad thing, however, as the whole point of this scope is that it does everything for you, without your having to push buttons and set settings. In my mind, this is the ultimate aim of technology; let the user do what seems logical, and have the equipment sort things out for itself.

The Fluke 123 Industrial ScopeMeter measures 232 x 115 x 50mm, and weighs just over 1kg. The 240 x 240 pixel display which occupies the top half of the unit has surprisingly high contrast, and a viewing angle to match. This combined with a nice bright backlight makes for a very readable display, even under difficult conditions.

Most of the functions of the scope are accessed from a series of pop-up menus, which are selected by a row of four software-defined keys (F1 - F4) along the bottom of the display. These menus do a good job of eliminating the need for a multitude of buttons on the front panel. As a result, the few remaining buttons are logically laid out and selecting any of the scope's 30-odd measurement functions is quite straightforward.

(Personally, though, I felt that the amplitude and timebase keys appeared backwards — you press the *top* of the button to *de*crease the amplitude and the *bottom* of the button to *in*crease it. Similarly the timebase key requires you to press the left hand side to increase the sweep rate, and the right to decrease it.)

Supplied with the Fluke 123 Industrial ScopeMeter are a pair of long, very flexible shielded leads. These terminate in what look to be rather fat meter-style probes, which can accept both plug-in grabber or crocodile clips. An earthing lead plugs into the rear end of the probe to provide a local earth connection for oscilloscope readings.

One thing that traditional scope users might find a little disturbing is that the other end of these leads terminate in what appear to be 4mm banana plugs. These turn out to be a specially designed shielded banana plug that mates with matching banana sockets on the top end of the ScopeMeter.

Fluke decided to use this type of socket instead of the more usual BNC connector for a couple of good reasons: the cables rotate smoothly in their sockets, preventing damage to the leads in strenuous conditions, and a pair of standard meter leads can be used instead if required.

These would, of course, be only suitable for taking DC or low frequency measurements, which brings up some interesting points about the probes/leads that Fluke supply. Firstly, the probes don't attenuate; that is they are 1:1 instead of the more common 10:1 or x10 scope probe. As well, in an effort to make the leads as friendly and as easy to use as possible (i.e., floppy and well mannered), Fluke decided to compromise in the overall frequency response of the scope. With the leads supplied, the -3dB frequency response of the scope falls from 20MHz down to 12.5MHz. This isn't as bad as it seems, however, as when you think about it most technicians would rarely encounter frequencies above 10MHz out in the field.

If they *do* need to go beyond this point, it's a simple matter to attach a standard shielded scope probe via the small BNC-to-banana adapter supplied. (Interestingly, Fluke see fit to include only one of these adaptors with this two-channel scope.)

The Fluke 123 ScopeMeter is battery operated, and runs off a small, easily removable NiCad battery pack. This pack contains four sub-C cells, and can power the ScopeMeter continuously for around four hours (five, if the backlight is dimmed).

An inline power transformer is supplied for both powering the scope on the bench and to recharge the batteries, and a menu selectable battery management system lets you perform a complete battery discharge/charge cycle on a regular basis, preventing the 'memory effect' all too common in NiCad-powered portable instruments.

The Scopemeter supports a separate 25MS/sec ADC on each of the input channels, and supports real-time sampling at sweep speeds up to 1us/div. Above this, the scope switches over to random-repetitive sampling, which can give the equivalent of a 1.25GS/sec sampling rate.

As with almost all top-end Fluke scopes, the ScopeMeter supports an optically isolated RS232 port, which can communicate with a PC running Fluke's own 'FlukeView' software. All major scope functions can then be controlled by the PC, which can also download data recorded in the field. This data can be a waveform, or data recorded while the Scopemeter was in TrendPlot mode.

In this mode, the Scopemeter effectively becomes a remote data logger, and can log data for a period extending to 16 days! The ScopeMeter can read in from both channels, time stamp each reading, and store the data internally until needed.

In summary then, the Fluke 123 Industrial ScopeMeter is an ideal choice for anyone who needs a scope on the job, whether monitoring power lines for spikes, or analysing readings while deep inside a piece of industrial equipment, where the last thing you want is to twiddle knobs and dials. And of course there is that other overriding factor: it's comparatively cheap, too. ❖

Fluke 123 Industrial ScopeMeter

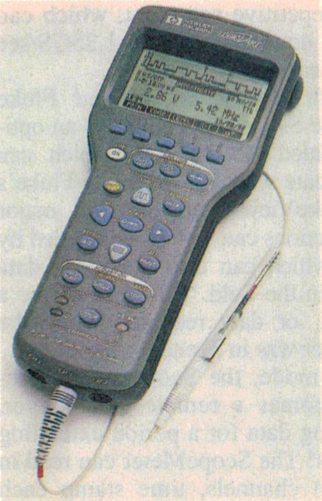
Good points: Robust and intelligent.
Bad points: It comes with over a dozen probes, tip adapters and cables — pay the extra and get a carry case.
RRP: $1990. ($1630 ex tax).
Available: From your local Fluke distributor.

Special Feature:

Current Test and Measuring Instruments

Advanced 100MS logic probe/analyser from HP

Hewlett-Packard has just released its new LogicDart, an advanced logic probe designed to give engineers a head start in troubleshooting and probing fine-pitch digital circuitry.



Much more than a conventional logic probe, the HP LogicDart incorporates a 100MS/s timing analyser, a logic monitor, a DC voltmeter and a continuity tester in a compact portable case. It provides data to the user audibly via various beeper tones, and visually with graphic timing displays and blinking LEDs.

For analysing signal timing, the LogicDart has a sample rate of 100MS/s across its three independent input channels. It can display all three channels simultaneously with up to 10ns resolution, and can store up to ten 2048-sample waveforms in its internal memory. Each channel has independent triggering and all three channels can be set up for edge, pattern and edge/pattern-combination triggering.

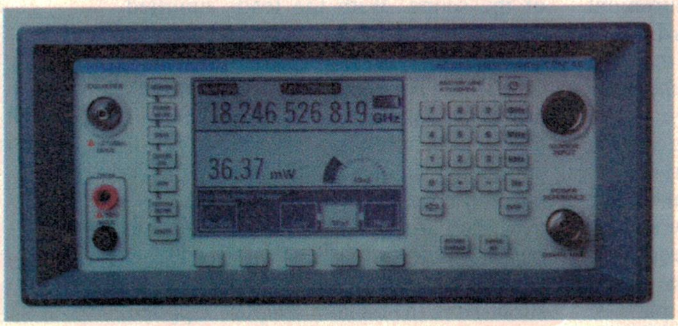
The HP LogicDart also has pan and zoom capabilities, allowing the engineer to use display cursors for precise delta-time measurements. It is preset for TTL, ECL and CMOS, but can also handle custom logic.

Additional features include DC voltage measurement, continuity, diode test and frequency measurement. The 3.5-digit resolution available for DC volts measurement allows supply rail, logic threshold and loading checks.

The HP LogicDart is battery operated, but also comes with an AC power adaptor. An option allows printing to a portable printer via an IR wireless link. Further information on the instrument is available at HP's Website: **www.hp.com/info/LogicDart5.**

Portable counter and power meter

The new CPM counter power meter from Marconi Instruments combines two instruments in a single, portable unit: an integrated microwave frequency counter and true power meter for microwave link installation and maintenance requirements.

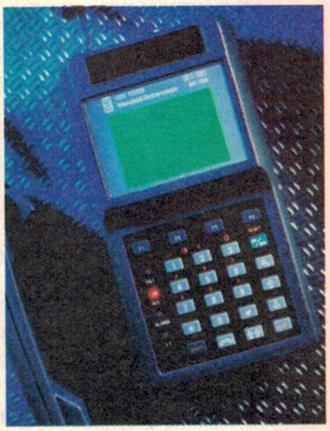


Two versions are available to meet the standard international radio link frequencies: CPM 20 (to 20GHz) and CPM 46 (46GHz). The unit weighs 4.5kg, including battery and ruggedised casing and has a three hour continuous battery life.

For immediate operation, the frequency counter uses a special digitally controlled temperature compensated crystal oscillator which requires no warm up period. The instrument is claimed to be extremely accurate because it uses Marconi Instruments' 6900 series power sensors, which have a dynamic range of -60dBm to +44dBm. Its transflective LCD display shows instrument status and both power and frequency measurements simultaneously.

Features include relative frequency readout to speed up transmitter tuning; an analog peaking meter to facilitate peaking and nulling when tuning output power; offset modes and limits checking. It also comes with a built-in digital voltmeter for receiver AGC measurements, to assist in antenna alignment.

For further information circle 202 on the reader service coupon or contact Marconi Instruments, 1/38 South Street, Rydalmere 2116; phone (02) 9638 0800.



Basic rate access tester for ISDN

Wandel & Goltermann has introduced a new basic rate access tester, the IBT-10U. It includes all the functionality of the IBT-10, such as TE simulation, protocol analysis, X.25 tests, service tests and NT simulation, with the added advantage of a built-in U interface.

The instrument is designed for commissioning and maintaining ISDN line equipment. To allow verification of the availability of a particular service, the instrument can automatically test different ISDN services, such as telephone, fax and videotext. It can also test several supplementary services such as multiple subscriber number (MSN), caller identification (CLIP) and sub-addressing (SUB). It supports major ISDN protocols, and features an intuitive menu structure, programmed function keys and LEDs to display errors and alarms, a large backlit graphics screen, 30 hour battery life, ergonomic keypad and separate, high quality handset.

For further information circle 203 on the reader service coupon or contact Wandel & Goltermann, 42 Clarendon Street, South Melbourne 3205; phone (03) 9690 6700.

Electrical testers

The Pantec 900/800 series is a family of testers especially designed for testing electrical installations. Included in the range are analog and digital insulation testers, earth fault loop resistance testers, digital RCCD meters and earth resistance testers.

Two analog insulation testers, the MIS840 and MIS845 measure insulation resistance up to 40MΩ and 100MΩ respectively, with test voltages of 250, 500 and 1000 volts, and a test current of 1mA. The MIS930 is a digital insulation tester with similar functions that also has a low ohm range of 0-20Ω and DC voltage measurement up to 200V.

The MID920 digital RCCD meter tests the trip time of residual current circuit breakers. The MIT904 comprises a digital tester for earth electrode resistance, earth resistivity and insulation resistance, all electrodes and cables and test clips plus a battery charger, all housed in a carrying case. It measures earth resistance down to 0.01Ω and insulation resistance up to 200MΩ, plus 600V AC.

The MIL910 digital loop meter is for measuring earth fault loop resistance, earth resistance, line resistance and prospective short circuit current, and is mains powered.

For further information circle 204 on the reader service coupon or contact Obiat, PO Box 37, Beaconsfield 2014; phone (02) 9698 4111.

LED panel meters take only 50mW

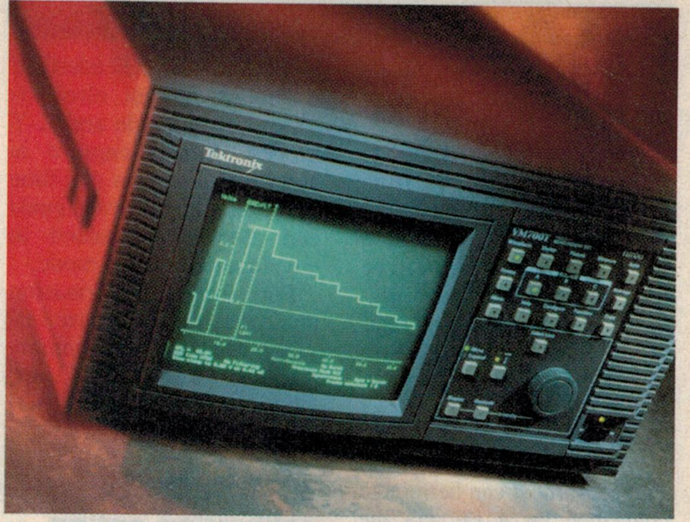
Datel's new DMS-30PC-RL series of panel meters are claimed to be the world's lowest power, LED display, digital panel voltmeters. The meters incorporate a 14mm high, low-power, red LED display and draw only 10mA from a single +5V supply.

The meters are housed in extremely rugged, epoxy encapsulated, component-like, 12-pin DIP packages that measure 56 x 23.5mm. The packages incorporate a built-in colour filter and bezel and are approximately 13mm deep. The meter's internal A/D converter is a precision, auto-zeroing device that operates from a factory-trimmed reference.

The meters are available in three standard differential input voltage ranges of +/-200mV, +/-2V and +/-20V. The high impedance (up to 1000MΩ) inputs are over-voltage protected to +/-250V and have a common mode rejection of 86dB. All models feature autopolarity changeover and over-range indication.

For further information circle 207 on the reader service coupon or contact Quiptek Pacific, PO Box 42, Southland Centre Post Office, Cheltenham 3192; phone (03) 9553 5000.

Video measurement set



Tektronix has announced its new VM700T video measurement set as a replacement for its VM700A. The instrument has a new, faster core and includes a waveform monitor, vectorscope, picture monitor, automatic graphics measurement display and audio measurement (option 40) capabilities in the same case. It automates most standard measurements and provides avenues for remote (modem) or test system (GPIB) applications.

According to Tek, applications run up to three times faster compared with the VM700A. The instrument is 100% compatible with the VM700A, has a parallel printer port for measurement documentation via a copy button, and has automated measurements via front panel and user-definable macros. It tests to international standards with options for NTSC, PAL or both.

Applications include automating video measurements in production, distribution, broadcast, manufacturing, and R&D applications.

For further information circle 206 on the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113; phone (02) 9888 7066.

150MHz scope also samples at 200MS/s

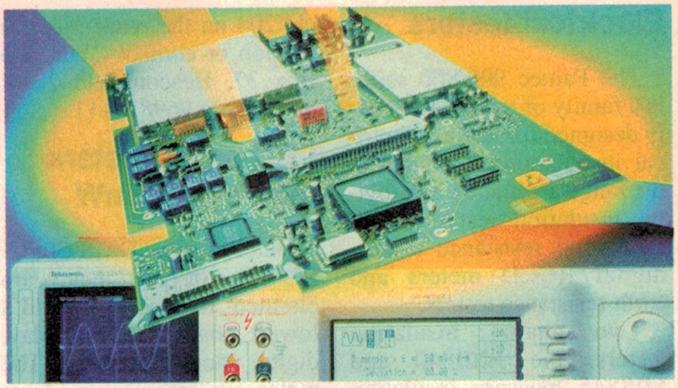
The new HM1507 150MHz analog/digital scope from Hameg samples at 200MS/s in digital mode and features a second timebase which can be operated in free run and triggered in both analog and digital modes. Functions such as trigger point indicator, autoset, save/recall, readout and cursor supported measurement are also available in analog mode. The instrument can be remote controlled by a PC via the built-in RS-232 interface.

A single pushbutton switches the 'scope to digital operation, with a maximum sampling rate of 200MS/s. Each channel is equipped with an 8-bit flash A/D converter. Compared with the analog mode, the main advantages of digital mode are: single event capture, flicker-free display of low frequency signals and the possibility of signal documentation via the RS-232 interface.

The instrument also has refresh, roll, single and X-Y modes. Signal capture is always executed in real time mode and repetitive signals can also be enhanced in envelope or average mode.

For further information circle 201 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.

600MHz scope calibration option



Wavetek has introduced a 600MHz Oscilloscope Calibration Option for its Model 9100 Multi-Product Calibrator, allowing in-house and commercial calibration labs to include this important class of instruments in their day-to-day operations.

Option 600 fits inside the Model 9100 and can be fully integrated into the calibrator's front-panel user interface and IEEE-488 control capabilities. It provides all calibration waveforms required to calibrate analog and digital storage oscilloscopes up to 600MHz bandwidth. These include precision DC levels and squarewaves for vertical deflection calibration, levelled sinewaves from 10Hz to 600MHz for bandwidth testing, high speed rise/fall time 'return to ground' edges for input amplifier pulse response analysis and crystal-controlled timebase markers for high accuracy timebase calibration.

DC levels and squarewaves are continuously variable up to 130V, and high speed edges are variable up to 55V, allowing all V/div ranges and input multipliers on a scope to be rigorously checked. Timing accuracy of 0.25ppm allows accurate calibration of the precision timebases provide in the latest DSOs.

For further information circle 205 on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166; phone (03) 9569 1366 or fax (03) 9563 4728. ❖

NEW PRODUCTS

Handheld programmer is PC controlled

Stag Programmers has launched the P301, a handheld portable programmer that includes a Windows and DOS software package for remote control via a PC. The device is claimed as first handheld programmer with an infrared IrDA interface as well as an RS-232 port.

The programmer supports up to 32-bit structures based on 8-bit devices through a single wide-blade socket for 8, 24, 28 and 32 pin DIP packages with either 0.3" or 0.6" pitch. Supported devices include EPROMs, EEPROMs, serial EEPROMs and Flash/CMOS PROMs. Adaptors are available for PLCC, TSOP and SOIC devices.

The device support library can be updated and is held in non-volatile Flash memory. Device programming algorithm selection is menu driven either by the manufacturer's part name or automatically via an electronic ID. Stag also makes device library updates available free-of-charge on its Web site.

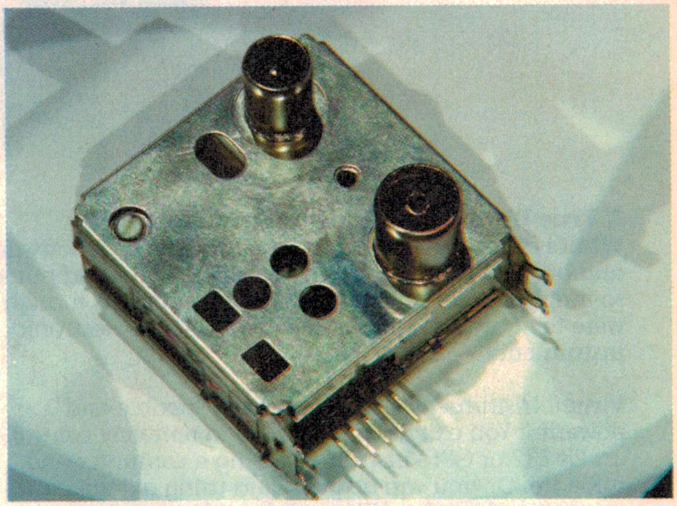
For further information circle 241 on the reader service coupon or contact Emona Instruments, PO Box 15, Camperdown 2050; phone (02) 9519 3933.

Home CCTV integrating module

A module is now available for integrating surveillance video cameras and the TV antenna system in residential installations. The module is fitted between the TV antenna and splitter in a multi-outlet system, allowing all TV sets and VCRs in the installation to be tuned to the output from a surveillance video camera. This also allows a video camera output to be recorded on a VCR.

The module combines a modulator, mixer and RF amplifier, and has a standard 75Ω 1V p-p composite video input, line level audio input, and 9.5mm RF antenna input and output sockets, and is installed in the antenna coax lead. Modulator output is in the UHF TV band and is adjustable between Channels 30 and 40.

The modulator output and amplified signals from the TV antenna are mixed internally, then sent to the 9.5mm male IEC RF socket. RF amplification is up to 7dB for signals between 47 to 854MHz (includes FM and TV signals). The unit measures 50 x 44 x 29mm and operates from 5V DC at 140mA. An in-built test signal simplifies initial tuning. The RRP is between $20 and $30.



For further information circle 248 on the reader service coupon or contact Allthings Sales & Services, PO Box 25, Westminster 6061; phone (09) 349 9413.

Printer adaptor for Fluke test instruments

Fluke Corporation has introduced the PAC91 print adaptor cable, so Fluke's test instruments equipped with an optical RS-232 serial interface can be connected to a printer via a parallel (Centronics) interface. Instruments that can use the adaptor include the Fluke ScopeMeter series, the 86X graphical multimeters, and the 41B power harmonic analyser.

The cable adaptor has a snap-on connector that connects to the instrument's optical RS-232 interface, and a standard parallel output to connect directly to a Centronics printer cable. It is powered by a 9V battery, and has an automatic shutdown feature when not in use.

For further information circle 244 on the reader service coupon or contact Philips Test & Measurement, 34 Waterloo Road, North Ryde 2113; phone (02) 9888 0477.

13.8V bench supplies

Imark Communications has released two Australian designed and manufactured regulated power supplies for use with commercial, amateur, and CB transceivers; security systems; control equipment or automotive equipment in service workshops or manufacturing plants.

The Imark PS20 and PS40 power supplies provide 3A or 5A peak at 13.8V DC, over-current and short circuit protection. They come with an on-off switch and front panel LEDs to indicate AC on, DC on/off, and 'OUTPUT OK'. Large filter capacitors provide a low noise output and the 1.6mm aluminium chassis provides effective heat dissipation. Dimensions are 148 x 125 x 60mm (DWH). Binding posts are mounted on the front panel and threaded fasteners and screws are used throughout the construction.

For further information circle 242 on the reader service coupon or contact Imark Communications P/L, Unit 2, 75 Mark Street, North Melbourne 3051; phone (03) 9329 5433.

27MHz AM CB radio with Ch8 priority chip

Standard Communications has released the new GME Electrophone AM CB, the TX1000. The radio is an entry level 27MHz unit and is a replacement for the TX822. It includes a specially developed Channel 8 priority chip, giving instant access to the truckies' road alert channel.

Other features include electronic channel change with large numeric LED readout, separate squelch and variable RF gain controls, selectable noise limiter switch, transmit and receive signal strength level indicator and facility for an external extension speaker. It also has a last channel memory, so it returns to the last selected channel when the Channel 8 button is released. The radio has a twelve month parts and labour warranty.

For further information circle 246 on the reader service coupon or contact Standard Communications, PO Box 296, Gladesville 2111; phone (02) 9844 6666.

432W compact switching regulators

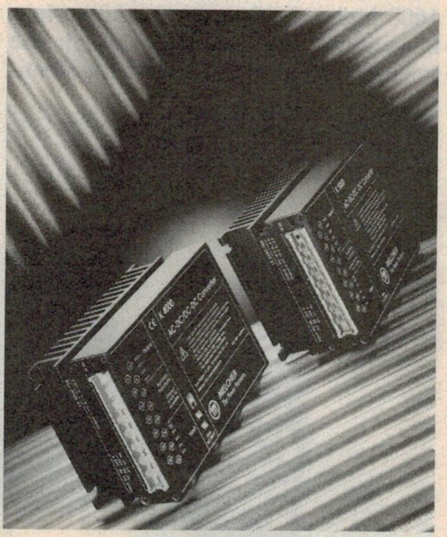
Power supply manufacturer Melcher has announced its new PSS family of switching regulators, with an output from 5V to 36V at 12A, an input up to 80V DC and a conversion efficiency ranging from 80% to 96%. The rack mount units are 60mm wide and the chassis mount types are 52mm high.

The units can operate in an ambient temperature up to 71°C without derating, and don't need additional heatsinking or forced air cooling. They can be powered from rectifiers, batteries, or semi-regulated power sources, and provide a regulated, low noise output with a claimed excellent dynamic response capability. They are continuously short and open circuit proof, and standard features include sense-lines, true current share for parallel operation, inhibit, and an adjustable output to 42.5V DC.

For further information circle 247 on the reader service card or contact Scientific Devices Australia, PO Box 163, Oakleigh MDC 3166; phone (03) 9569 1366.

150W AC-DC converters

Melcher has broadened its product range of 150W AC-DC converters with the addition of a power factor corrected version, the LK 4/5000.

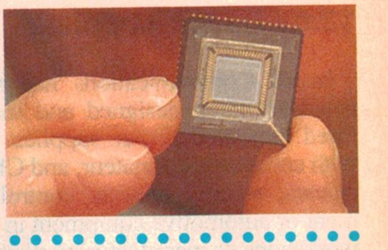


Converters in the series operate over a universal input voltage range of 85V to 255V RMS with a power factor better than 95% and harmonic currents well below the limits specified by IEC 1000-3-2/EN 61000-3-2. They are available with either a single output voltage of 5.1V, 12V, 15V and 24V or with two galvanically isolated outputs of 2 x 12V, 2 x 15V and 2 x 24V, allowing configuration of output voltages from 5.1V to 48V (nominal), which can be externally adjusted.

The outputs conform to SELV and are no-load, overload and short circuit proof. An inhibit input allows the outputs to be enabled or disabled. The units have an efficiency of up to 86%, and can be connected in parallel.

For further information circle 245 on the reader service coupon or contact Scientific Devices Australia, PO Box 163, Oakleigh MDC 3166; phone (03) 9569 1366. ❖

Silicon Valley NEWSLETTER



FCC opens door to digital TV era

The US Federal Communications Commission has officially opened the door to all digital high-definition television broadcasting, by approving a set of rules that give broadcasters free licences to start HDTV broadcasts, the first of which will reach viewers in major cities within 18 months. The move comes 10 years after the FCC initiated its search for an HDTV standard.

In making the announcement, the FCC predicted that its new rules call for 30% of US households to receive HDTV broadcasts of at least three digital TV stations by May 1, 1999. That goal appears well within reach, since already two dozen stations in the top 10 markets have committed to being on air with HDTV signals within 18 months.

The FCC decision did not come without a storm of protest from Congress and other interests, who charge the FCC is giving away billions of dollars worth of HDTV licences to 1500 TV broadcasters. The FCC, itself, has valued the digital airwaves at up to US$70 billion.

For its part, the FCC argues that the free licence agreements will ensure HDTV will be implemented quickly, allowing cost of equipment and TV sets to come down quickly, thus saving consumers billions of dollars.

Teenager claims major chip invention

Has a 17-year-old high school student beaten the entire global semiconductor industry, with billions of research dollars, in coming up with a way to dramatically increase circuit densities on a chip? Could be. Adam Ezra Cohen, a senior at Hunter College High School in New York, has won a US$40,000 college scholarship for an invention the student claims can print integrated circuits 16 times denser than in today's state-of-the-art semiconductors.

He has called the technique 'near-field photolithography', and it's certain to get scrutinized for practical application by various interests in the semiconductor and equipment industries.

The technique is said to allow for clearer printing of circuit images, because it doesn't rely on optical lenses which have difficulty creating sharply focused images below 0.25 microns.

Cohen used a scanning tunnelling microscope he built in his bedroom to test his new photolithography invention. The circuit printing technique uses what he calls an 'electrochemical paintbrush', which creates nanoscale deposits of copper on a transparent electrical conductor.

The lithography technique is but the latest in a series of inventions Cohen has made — including a new type of hard disk drive for which he won a $10,000 science fair prize, and a mechanism that allows users to control a computer cursor with their eyes. He plans to study physics at Harvard.

Cohen won the prize in the 56th Westinghouse Science Talent Search contest, which was entered by more than 1600 high school students with various inventions. The annual Westinghouse science contest is well known for identifying top scientific talent while still in high school, and counts five Nobel Prize winners among past finalists. Hundreds of other participants have achieved outstanding careers in research, mathematics, medicine and engineering.

HP/Chartered chip venture in Singapore

Hewlett-Packard has entered into a joint venture with Singapore chipmaker Chartered Semiconductor, to build a new chip factory to produce various integrated circuits to supply H-P's fast growing operations throughout Asia.

The fab, which will produce up to 30,000 8" wafers per month, will produce logic and other chips to power HP's workstations, printers, calculators and desktop computers. While HP will consume a large portion of the facility's chip output, additional production capacity will be used for other Chartered IC products marketed on the open chip market.

The joint venture will be known as

Another US firm working on interactive TV products is Curtis Mattes, which displayed its 'uniView' line of set-top box products at the recent CES. The products are powered by an ARM RISC processor and run the Acorn operating system; they will allow users to access the Internet and TV program listings, along with e-mail, telephone and fax functions.

Chartered Silicon partners. Its facility, to be constructed in Singapore, will cost around US$700 million. HP will be a minority shareholder in the new company, with Chartered and other partners making up the majority.

The joint venture extends a close relationship HP and Chartered have had since the latter became a major chip supplier to the Palo Alto computer and electronics firm. HP has seven production facilities in Singapore, employing some 9000 workers.

AMD strikes back with its K6 chip

Whatever may happen in the personal computer market in the next 12 months, one thing is certain: Advanced Micro Devices will be a different company. Following the launch of its new K6 microprocessor, the company stands ready to reap in billions of dollars in revenues and profits.

Never at a loss for words with which to take a swipe at Intel, AMD chairman Jerry Sanders proclaimed the launch of the chip an epic event in the computer industry, "This is a case of the good guys against the bad guys. It's The Return of the Jedi. We're the Jedi."

With the launch of the K6, Intel, for the first time, will have to slug it out in the high-end of the PC processor market with a capable competitor. The K6 can compete head-on with Intel's best, the forthcoming Pentium II. What's more, some media tests, including those by Germany's *CT Magazin*, have hailed the K6 chip as superior to the PII because of its lower price and backward compatibility to existing Pentium systems. The PII is based on a new system design.

AMD is expected to ship between two and four million K6 chips in 1997. At US$300 to $600 the K6 will be far more profitable than any of AMD's older PC processor chips. Comparable PII processors will sell for $600 - 750.

"This is a watershed event. It is the first time somebody has ever made a product that is competitive with the latest generation technology from Intel", said analyst Mark Edelstone. Edelstone and other analysts agreed the impact of the K6 will be seen quickly in prices of high-end PCs.

A full-featured Pentium II system is likely to retail at around US$3000, compared to $2500 for a similar K6 computer. Without the K6 threat, the new Pentium II computers would probably have retailed for $3500 or higher.

AMD's new high-profile position in the processor market is a stunning turnaround from two years ago, when it looked like the firm had fallen too far behind in the race to develop Intel-compatible chips. AMD seemed on its way out of the Intel processor market. Then in October 1995, it made a bold US$600 million gamble by purchasing Nexgen, a small company that had technology that could match Intel's best, and was free of legal liabilities.

Apple: still more take-over rumours

Apple Computer has recently been getting more media attention than IBM, Microsoft and Intel combined. Between reports of massive lay-offs and staggering financial losses, the 'Return of the Jedis' (Steve Jobs and Steve Wozniak), Larry Ellison's second hostile take-over attempt, and a fairy tale Arabian Prince jumping onto the 'Save Apple' bandwagon, presses in Silicon Valley have been running overtime to record and report it all.

Now, amidst all the mayhem in Cupertino, new rumours are surfacing that Apple is working on a backdoor deal to get out of its quandary by seeking a merger on its own terms. Reportedly, Apple has been talking with Sun Microsystems, the company that tried, but failed, to engage in a merger with Apple a year ago. Those talks broke down when Apple refused to consider a $25/share offer. Apple is now trading at around $19/share...

As if the action on the corporate battlefield wasn't enough excitement, Apple has now launched two new Power Macintosh systems that put an impressive 50-80MHz performance gap between it and the fastest Wintel machines — including the forthcoming K6 and Pentium II machines. And the company still has 530MHz machines coming down the pipe for later this year.

The new Power Mac 6500/300 runs on a 300MHz PowerPC 603e chip. The machine will retail in the US for an aggressive $3000, including 64MB of memory and a 4GB hard drive. Apple also unveiled a dual Mac/Windows PC (Model 7300/180) machine that runs at a respectable 180MHz and comes with both the Mac and Windows 95 operating systems. Both machines are aimed at the consumer and small business markets, and come with a bundle of pre-loaded applications and CD-ROMs.

"You can believe that these systems are going to get the attention of the general computer consumer", said market analyst Tim Bajarin at Creative Strategies in San Jose. Bajarin said that with products like this, Apple "would be crazy not to try to get over this hump alone." He said the company has at least three to six months to evaluate how its new business plan is working and how the market responds to the record-breaking performance desktop and laptop systems the company has launched in the last two months.

Apple's new major shareholder Prince Alwaleed Bin Talal Bin Abdulaziz, meanwhile, said he still wants to talk to both Larry Ellison and Apple chairman Gil Amelio to see who has the better plan for Apple's resurrection. "I've got to sit down with the management and hear what they have to say. While Apple Chairman Amelio has said he is turning the company around, I need to see what is in his pocket and be convinced of that privately."

Lam acquires Ontrak

Consolidation continues in the embattled semiconductor equipment market, with Fremont-based Lam Research acquiring Ontrak Systems of San Jose in a stock swap valued at US$250 million. In 1996 Ontrak sold US$56 million worth of so-called chemical-mechanical polishing (CMP) systems, which use brushes and a silicon-based slurry to polish oxide films deposited on silicon wafers.

Besides a larger share of a rapidly growing market, the Ontrak acquisition provides Lam with an influx of much needed management talent. The US$1.2 billion manufacturer of etch and chemical vapour deposition (CVD) systems has recently experienced problems in manufacturing.

Taking over as chief executive officer of the combined company will be Jim Bagley, the former chief operating officer at industry leader Applied Materials, who joined Ontrak just six months ago. Lam CEO Roger Emerick will continue as chairman.

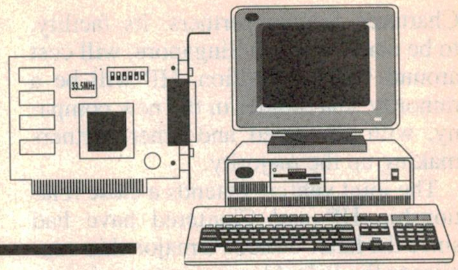
"This is the most interesting employee acquisition in history", commented VLSI Research's president Dan Hutcheson, in an apparent reference to Lam's reputation for being too light at the top.

Added industry analyst Brett Hodes: "Lam has superior technology and customer relations, but they've had problems with production. Bagley is famous for his operational skills."

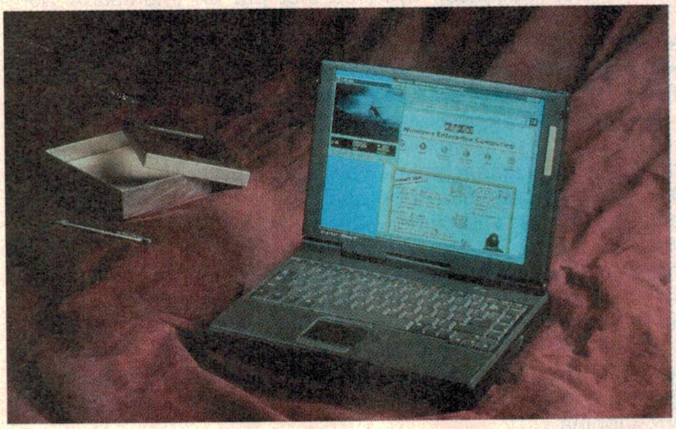
Analysts agreed that besides the implications for management, the deal also made good overall business sense. CMP is fast becoming an integrated part of the chip manufacturing process, particularly in the area of microprocessors and other advanced ICs.

Lam Research said it doesn't expect the merger, which will add 350 people to its payroll of 4600, to cause any new rounds of layoffs. ❖

Computer News and New Products



Digital notebooks offer 12.1" displays



Digital Equipment Corporation's new HiNote VP 500 range of notebook personal computers is claimed as the first to incorporate a removable CD-ROM/diskette combination drive, allowing users to access the floppy disk drive and CD-ROM simultaneously.

The PCs are also claimed to be the first notebooks to include a 12.1" SVGA colour display as standard. Windows 95 is also standard. The top model of the HiNote VP 500 range includes Windows NT Workstation 4.0 pre-loaded and pre-configured. Digital claims to be the first company to offer Windows NT-optimised notebooks across its full mobile platform.

The PCs also include 128-bit accelerated graphics with MPEG (Motion Pictures Expert Group) support for rich, full-screen/full-motion video playback. Other features include 32-bit enhanced CardBus support for faster throughput of PC-card communications, Zoomed Video for high-speed graphics performance in full-motion video applications and Fast Infrared for higher data transfer rates when using wireless computing devices. 133MHz Pentium processors are fitted in the HiNote VP 560 and 565 and a 166MHz Pentium processor with Intel's recently announced MMX technology in the HiNote VP 575.

All systems use the PCI bus and feature EDO (Extended Data Out) memory. A minimum of 16MB of system memory is standard, expandable up to 80MB. Removable hard drives provide up to 1.4 or 2.2GB of storage capacity for the HiNote VP 560/565 and 575, respectively.

For further information circle 160 on the reader service card or ring Digital's PC Action Line on 13 23 93.

Improved cartridge for HP printers

Hewlett-Packard has introduced the HP 92298X high-capacity toner cartridge (98X), which has 30% more toner volume than the HP 92298A toner cartridge (98A). The new cartridge is compatible with the HP LaserJet 4 and LaserJet 5 laser printers and can provide up to 8800 pages per cartridge, approximately 2000 more pages than the 98A toner cartridge. This is claimed to give a significant reduction in the cost per page, and to provide an environmental benefit due to fewer empty cartridges.

The new cartridge fits the LaserJet 4, 4 Plus, 4M, 4M Plus, 5, 5M and 5N laser printers. It has an RRP of $240 (incl tax), and the 98A cartridge has been reduced in price by 10% to $222.

For further information phone the HP Customer Information Centre on 131 347 (Internet at **http://www.hp.com**).

Free trial of 586 upgrade

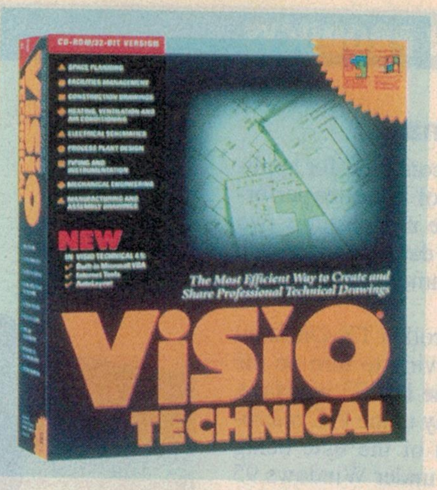
Hypertec, an Australian third-party PC memory company, has announced the HyperRace 586 processor, claimed to enhance the performance of 486-based personal computers to Pentium processor performance. The processor measures 5cm square and costs around $200. To allow users to evaluate the capabilities of the processor, Hypertec is offering free trial evaluations of the product to any existing 486 PC owner.

The processor upgrades 486SX, SX2, DX or DX2 computers that have Intel, Cyrix or AMD processors running at between 25MHz and 100MHz. The old processor is removed and replaced by the HyperRac 586 chip, which is a 133MHz AMD 586 CPU, with 16K of high speed internal cache. Depending on the configuration, this can provide a performance equivalent to a 66MHz or 75MHz Pentium processor. When combined with an additional 16MB of RAM, the chip is claimed to more than double the performance of a 486DX/33 computer.

For further information circle 161 on the reader service coupon or contact Hypertec P/L, 61 Talavera Road, Nth Ryde 2113; phone 131 307 (Internet **http://www.hypertec.com.au**).

Technical drawing tool

Visio Corp has announced the availability in Australia of Visio Technical 4.5, the newest version of Visio's technical drawing tool — said to give enhanced functionality in the areas of programmability, Internet tools and overall drawing productivity. This release follows the Australian release of Visio Professional 4.5, a new product for designing and documenting information and business processes that, like Visio Technical 4.5, incorporates Microsoft Visual Basic for Applications (VBA) and full Office 97 compatibility.



The program offers new tools to simplify the exchange of technical drawings between desktops and the Internet and corporate intranets. The Hyperlinking Wizard automatically creates links from a Visio Technical drawing to a URL address, as well as to another page or document. In addition, the 'Save as HTML' feature allows users to generate a set of HTML pages with image map capabilities, making it easy to navigate between pages on the Internet or intranets.

For further information circle 169 on the reader service coupon or contact Visio International Inc, Box 50, Waverton 2060; free call 1800 551 976.

Novel large format scanner

Abakos Digital Images has launched its new DeSKan Express desktop scanner, claimed to give a highly accurate large format scanning capability at an affordable price. Abakos has developed a way of locating a normal A4 motorised scanner in a special cradle and base to scan drawings in large AO and E size format in a series of strips. The saved strips are then corrected for distortion and mathematically joined into a precise single seamless image.

At the recent CeBIT exhibition, the product was singled out in the German press as one of the most innovative products on show from Australian exhibitors.

For further information circle 168 on the reader service coupon or contact Abakos Digital Images P/L, PO Box 142, Nundah, Brisbane 4012; phone (07) 3260 6162 .

16x CD-ROM drive

Teac Corporation has released a new 16x speed CD-ROM drive, the CD-516. The drive is available with an ATAPI (CD-S16E) or SCSI (CD-516S) interface and features a 1.8 to 2.4MB data transfer rate and 12x to 16x speed. A precision disc rotation controller automatically monitors and sets rotation speed to ensure data integrity.

The new drive is compatible with stand-alone systems, and maximum rotation can be set to 12x or 8x. It has a SCSI terminator reset fuse, a ball-bearing spindle motor drive, and a power loading tray that allows CDs to be loaded with one hand.

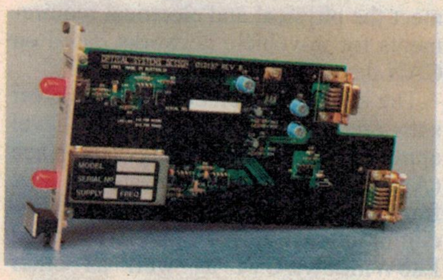
For further information circle 164 on the reader service coupon or contact Southend Data Storage, PO Box 25, Bangor 2234; phone (02) 9749 2633.

Optical modem handles DC - 1MB/s

Optical System Design (OSD) has announced its OSD137 modem card. The card plugs into the company's OSD370 chassis, which accepts up to 14 OSD standard cards and one OSD911 power supply module. The card is compatible with the OSD135 RS-422 module and has unique features such as TTL, RS-422 or RS-232 operation. It extends link lengths to 5km and is full duplex, asynchronous, DC to 1Mb/s.

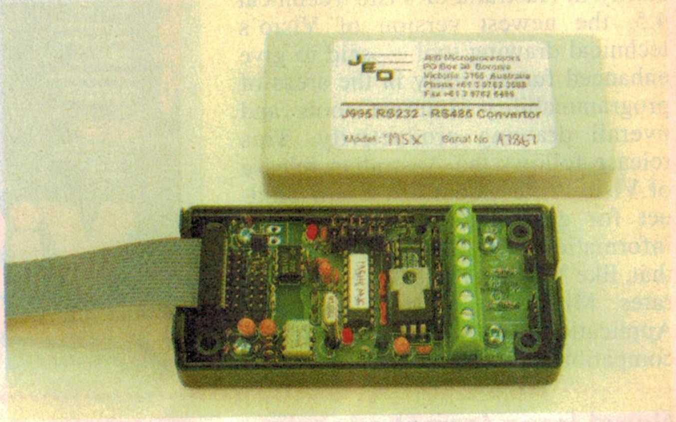
A pair of 0SD137 short haul modems (or a combination of 0SD135 and 0SD137 modems) and a duplex optical fibre cable form a link that is a direct replacement for twisted-pair extension cables. This link provides an effective way of extending cables between buildings while providing EMI/RFI protection, data security, reduced data error rate, and elimination of ground loops.

For further information circle 165 on the reader service coupon or contact



Optical Systems Design P/L, Unit 7, 1 Vuko Place, Warriewood 2102; phone (02) 9913 8540.

Converts RS-232 to RS-485, smartly



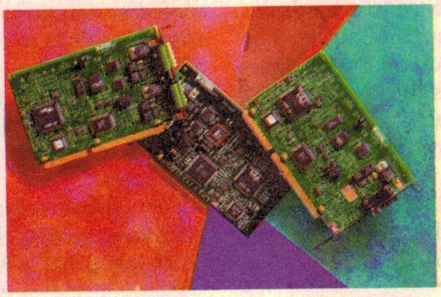
The J995X is a small RS-232 to RS-485 converter for applications where RS-485 is preferred because of its better performance characteristics. The Australian made unit features two 2.5kV rated opto-isolators that couple the data, one for each direction. This is claimed to eliminate common ground noise or surges due to interference.

The converter has a microprocessor-controlled TX-On function. So, rather than the user's program having to turn on the RS-485 transmitter with the RTS line of the RS232 interface, incoming data triggers a crystal-locked delay in the PIC microprocessor which matches the exact length of the byte being transmitted. This is useful for PCs running under Windows 95 or Windows NT, which have difficulties controlling and timing the RTS line.

Baud rates from 300 to 115,200 are supported, as are various data formats. The device is powered by an external power pack and is housed in a plastic case measuring 100 by 50 by 25mm.

For further information circle 163 on the reader service coupon or contact JED Microprocessors P/L, PO Box 30, Boronia 3155; phone (03) 9762 3588 (Internet: **www.jedmicro.com.au**).

CAN Interface cards for networks



National Instruments has announced PCI-based and ISA-based, Windows 95 Plug-and Play compatible interfaces that connect PCs to controller area network (CAN) devices. The PCI-CAN (for Windows NT/95 PCs) and AT-CAN (for Windows 95 PCs) are suitable for industrial automation applications and meet the physical and electrical requirements for in-vehicle networks based on CAN devices.

The interfaces include NI-CAN driver software, which provides a high-level application programming interface (API) for reading and writing data frames on the CAN bus. Both cards are compatible with LabVIEW and LabWindows/CVI as well as other industry-standard programming languages. The cards are claimed to give users PC-based connectivity to communications networks that are becoming more commonplace in both test and industrial automation applications, including automotive testing and diagnostics, factory automation, and machine control.

For further information circle 166 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 9879 5166 (Website at **http://www.natinst.com/**).

350mm LCD displays

Intelligent Systems Australia has announced the release of the PD-50F and PD-50N range of 350mm (13.8") colour liquid crystal displays. With a choice of TFT or DSTN technology, the displays have a 0.237 x O.237mm pixel pitch, a display resolution of 1024 x 768 and 256K colours, and anti-glare hard coating.

They weight 4kg and dimensions are 355 x 327 x 166mm. The response time is 3OOms (rise), contrast ratio is 300:1 and the brightness is 2OOCd/m^2. The PD-50F has an operating temperature of 40°C. Both displays conform to UL, CSA, CE, TUV/GS safety regulations and FCC-B and VCCI EMI regulations.

For further information circle 167 on the reader service coupon or contact Intelligent Systems Australia, PO Box 118, Berwick 3806; phone (03) 9796 2290 (WWW site at **http://www.intelsys.com.au**).

Portable PC has touch screen

Manchester-based British company QCL has just launched a new portable desktop PC featuring a touch screen.

The touch screen operates instead of a mouse, with objects and applications selected simply by touching their icon on the display. This system provides accurate control of the computer and particularly with menu driven applications, is claimed to enable operation at far higher speeds than using a conventional interface.

QCL have been leaders in the field of industrial touch screen solutions for 10 years and their products are found in hundreds of OEM applications, with 70% going to export. The new 'Maestro' PC shown at this year's CEBIT exhibition at Hannover extends the company's field of operations into office and retail environments.

Product design consultants London Associates worked with QCL during 1996 to design and develop the new hardware. The touch screen employs a 10.4" wide viewing angle colour LCD with TFT technology. An anti-glare coating is incorporated into the glass based top surface which protects against coffee spills, detergent cleaners and scratch marks. The unit also incorporates an adjustable viewing angle which even allows the screen to fold flat. This results in the size advantage of a laptop computer with the added security of a desktop machine. ❖

WEBWATCH

presented by GRAHAM CATTLEY

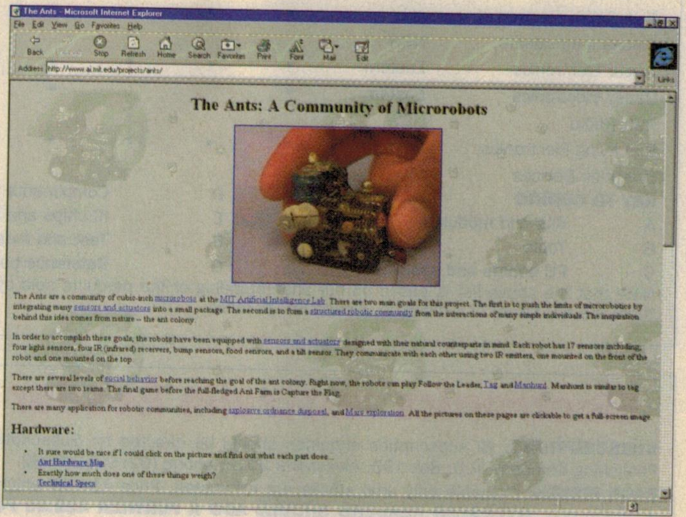
MIT's 'Ants'

http://www.ai.mit.edu/projects/ants/

This page is the home of 'The Ants', a micro-robotics project at the MIT Artificial Intelligence labs in Massachusetts. The Ants are tiny autonomous robots that are about a cubic inch in size. Based on the ever popular MC68HC11 microprocessor, these robots can be programmed to navigate through unknown territory, locate and pick up 'food', and communicate with other Ants via an inbuilt IR link.

This site contains a wealth of information about the design and construction of the Ants, along with downloadable MPEG videos of Ants in action. The people at MIT's AI division are trying to create a structured robotic community based on the interactions of many simple individuals. The inspiration behind this idea comes from nature — the ant colony.

Among the many pages at the site are links to other robot-related web pages, and of course a link back to MIT's AI site where you can see demonstrations and simulations of MIT's other robotics projects.



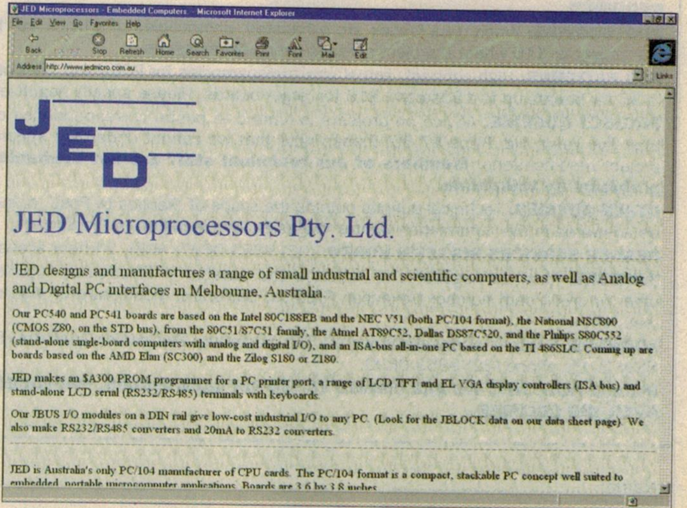
JED Microprocessors

http://www.jedmicro.com.au/

Melbourne based JED Microprocessors designs and manufactures a range of small industrial and scientific computers, as well as analog and digital PC interfacess. Their web site lists their entire range of micros and embedded systems, and they have data sheets for most of their products available online in Adobe .pdf format, as well as in faxable form.

While you're there, you can take a look at an automated penguin weighing station installed in Antarctica, using a JED embedded system.

At first glance there doesn't seem to be much else on this site, but hidden away a few levels down is a page of links including links to 380 semiconductor companies on the net, and an electronic resources site with links to FTP sites, magazines and newsgroups in the industry. JED also has a list of the 25 best and worst semiconductor sites on the Web, so check them out and see what you think...

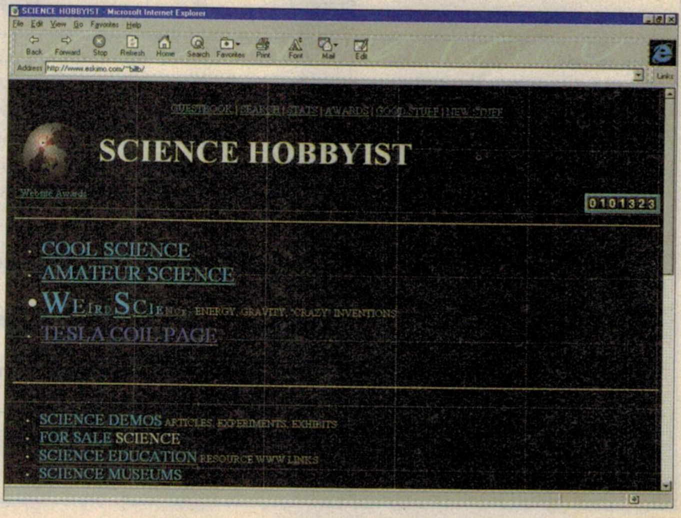


Science Hobbyist

http://www.eskimo.com/~billb/

This site is fun. On the WWW since late 1994, it's a collection of interesting — and different — links to science resources on the net. As the screen shot might suggest, these aren't the usual dry research-paper-type sites. Instead, you get links to such subjects as: How to make your own holograms by hand; Designing and building Tesla coils, and other Tesla-inspired devices; as well as links to science museums end educational resources. There's even a For Sale/Wanted page for people interested in such things as crystals of pure germanium, or Litton twin-chuck glassblowing lathes...

There's the usual crop of anti-gravity devices, UFO detectors and the like, but on the whole it's quite an enjoyable site and pretty much guaranteed to keep you logged on for hours. If you're looking for information on anything from static electricity to Richard Feynmann, why not give it a go. ❖



EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
Altronics	WA	•	•	•	•	•	•	•
Dick Smith Electronics	ALL	•	•	•	•	•	•	•
Emona Instruments	NSW						•	
Jaycar Electronics	Eastern	•	•	•	•	•	•	•
Oatley Electronics	Eastern	•			•	•		
RCS Radio	NSW			•				
Rod Irving Electronics	Eastern	•	•	•	•	•	•	•
Scientific Devices	VIC						•	

KEY TO CODING

A	Kits and modules
B	Tools
C	PC boards and supplies
D	Components
E	IC chips and semiconductors
F	Test and measuring instruments
G	Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Company, P.O. Box 199, Alexandria 2015; phone (02) 9353 9992.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

PHOTOCOPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria NSW 2015; phone (02) 9353 0620.

PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

Name:..

Address:..

....State:....................................Postcode:.......................

....

Back issues:...

....

....

Photocopies:...

....

....

Amount: A$..

Signature:...(Unsigned orders cannot be accepted.)

Method of Payment: (Please circle correct method.) Credit card / Cheque / Money order.

Credit cards accepted:

Mastercard, American Express, Visa Bankcard (please circle applicable card).

Expiry date:...

....

ADVERTISING INDEX

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

LIMITED STOCK SPECIALS

- BRIDGE RECTIFIERS: 35A - 400V in diecast aluminium: **5** for **$15**
- TRIACS: Mitsubishi BCR8PM-8L 8A/400V in insulated casing similar to TO220: **10** for **$14**
- SCHOTTKY DIODES: Motorola MBR745 7.5A/45V TO220: **10** for **$18**
- DC FAN: small DC motor with 3 blade push on plastic fan: **$3**
- PLASTIC HANDLES: Robust recessed, for stage speakers and equipment, 10 mounting holes, dimensions 130 x 170 x 50mm: **$5**
- PLASTIC CORNERS: Robust, dimensions 80 x 80 x 80mm: **$1.30**

MAGNIFIERS / LOUPES

Reviewed SC May '96, four magnifiers: small jewellers eyepiece with plastic lens: **$3**; twin lens loupes: 50mm **$8**, 75mm **$12**, 110mm **$15**. ***SPECIAL***: Buy set of four magnifiers for total price of **$25**.

KIT OF THE MONTH

We are producing many more exciting kits than the magazines can publish! We will try to release at least one new kit every month and give you a detailed description on our WEB SITE. Just 'click' onto the KIT OF THE MONTH icon on our WEB SITE. Coming: ■ laser beam communicator ■ low cost car alarm ■ laser fence ■ new time lapse interface for CCD camera – VCR security ■ low cost 2-channel UHF remote control with a ready-made transmitter ■ very effective 10 LED IR illuminator etc.

VERY LARGE 7 SEGMENT DISPLAY

Used attractive red high output 30mA common cathode display. 57mm high digit in a 70 x 43 x 12mm housing with a grey face. Forward voltage is 2V for the decimal point and 8V for the segments. **$6.50** ea, or seven soldered on one PCB: **$30**

MIDI KEYBOARD

Quality MIDI keyboard with 49 keys, 2-digit LED display, MIDI out jack, many functions including wheel, transpose. Size: 655 x 115 x 35mm. Computer software included, see review EA Feb. 97: **$88** 9V DC plugpack: **$12**

STEPPER MOTOR DRIVER KITS

Kit includes a large used 1.8º. (200 step/rev) motor and used SAA1042A IC. Can be driven by external or an on-board clock; has a variable frequency clock generator. External switches (not provided) or logic levels from a computer etc determine CW or CCW rotation, half or full step operation, operation enable/disable, clock speed. PCB and all on-board components kit plus 1 or 2 motors: **$18** for kit with 1 motor, **$28** for kit with 2 motors.

INTENSIFIED NIGHT VIEWER KIT

Last chance — slightly blemished 3-stage image intensifier tubes as previously advertised. Comes with power supply and eyepiece. 25mm (N04) **$220.** 40mm (N05) **$260**

DISCO LASER LIGHT SHOW PACK

Used 5mW helium-neon laser tube, 12V Laser Power Supply kit, used Wang power supply and Automatic Laser Light Show Kit: (K83S) **$195**

CCD CAMERA

Tiny (32x32x27mm) CCD camera, 0.1 lux, IR responsive (works in total dark with IR illumination), connects to any standard video input (eg VCR) or via a modulator to aerial input: **$125**, **REGULATED 10.4V PLUGPACK** to suit: **$11** (Normally $25)

KITS FOR CCD CAMERA SECURITY

New INTERFACE KIT FOR TIME LAPSE RECORDING: now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: **$25** for PCB and all on-board components, used PIR to suit: **$12.**

■ **32mm 10 LED IR ILLUMINATOR** new IR (880nm) LEDs have an ouput about equal to our old 42 LED IR illuminator: **$18.**

■ **32mm AUDIO PREAMPLIFIER** An **$8** kit that produces a 'line level' signal from an electret microphone, connect the output to our

■ **UHF VIDEO TRANSMITTER ($30)** or **$20** when bought with the camera. for a complete Audio-Video link.

■ **32mm AUDIO AMPLIFIER:** An LM380 based **$9** audio power amplifier which can directly drive a speaker — needs the 32mm preamplifier. *WHAT IS 32mm?* All these boards have a diameter of 32mm so you can house 1 or more of these kits in a plastic 32mm joiner: Inexpensive plumbing part.

SWITCH MODE POWER SUPPLY

Compact (50 x 360 x 380mm), in a perforated metal case, 240V AC in, 12V DC/2A and 5VDC/5A out: **$17**

VISIBLE LASER DIODE MODULE

Very bright (650nm/5mW) focusable module, suits many industrial applications, ideal for a disco laser light show and with our Automatic Laser Light Show: (L14) **$75**

AUTOMATIC LASER LIGHT SHOW

Three motors, mirrors, PCB and component kit. Produces a huge range of amazing patterns: (K83) **$77**

KEYCHAIN LASER POINTER

Very bright 650nm/5mW: **$65**

COMPUTER CONTROLLED STEPPER MOTOR DRIVER KIT

PCB and components kit plus information and IBM software: (K21) **$35**. Kit plus 2 stepper motors (small M17 or large M35) (K21M): **$48**

5mW/650nm VISIBLE LASER POINTER KIT

YES, NEW 650nm kit. Very bright! Makes a complete laser pointer that works from 3–4V DC. Includes 650nm/5mW laser diode, new handheld case 125x39x25mm, adjustable collimator lens, PCB battery holder: (K35) **$39**

HE-NE LASER TUBE AND SUPPLY

Used 5mW/633nm red helium-neon laser tube and our 12V laser power supply kit. Ideal for light shows. Head size: 380x45mm (l x dia): (L03) **$110**

12V - 2.5W SOLAR PANEL KIT

US amorphous glass solar panels with backing glass: (S12) **$22** ea **4** for **$70**

8-CHANNEL IR REMOTE

Add a remote control to anything with this kit. Has a commercial remote control transmitter. Transmitter kit: (K65T) **$20.** Receiver: (K65T) **$20**

4-CHANNEL RELAY KIT

Ref SC (Circuit Notebook) Aug 95. Kit drives any of four relays according to logic level input signal. Either toggle or momentary operation. LED indicators for each relay. 12V coil, 2A contact rating. (K68) **$30**

VISIT OUR WEB SITE

Visit our very active (continuously updated) WEB SITE. You will find ■ our complete catalogue ■ kit of the month ■ new releases and product highlights ■ stop press ■ more info on our advertised items ■ ordering information: http://www.ozemail.com.au/~oatley

WOOFER STOPPER Mk II

Works on dogs and most animals, ref SC Feb 96. PCB and all on-board components, transformer, electret mic & horn piezo tweeter: (K77) **$43**, extra tweeters (drives 4): **$7** ea Approved 12V plugpack (PP6) **$14** **UHF REMOTE TRIGGER** Single channel Rx and Tx: (K77T) **$40**

LED BRAKE LIGHT INDICATOR KIT

Ref SC Aug '93. Has 60 high intensity LEDs (550 to 1000mC) on two PCBs. Highly visible display equal to or better than those on many late model luxury cars. Each PCB measures 230 x 28mm, takes 250mA at 13.8V (K14) **$25** Another version which can be customised to produce sweep patterns is also available.

CYCLE - VEHICLE COMPUTER

BRAND NEW SOLAR POWERED MODEL. Intended for bicycles, but can be adapted to any moving vehicle. Could also be used with an old bicycle wheel to measure distances. Top of the range model. Weather and shock resistant. Functions: speedometer, average speed, maximum speed, tripmeter, odometer, auto trip timer, scan, freeze frame memory, clock. Programmable for operation with almost any wheel diameter. LCD readout. Main unit can be unclipped to prevent it being stolen. Weighs only 30g. Max speed reading 160km/h, max odometer reading 9999km. maximum tripmeter reading 999.9km. Dimensions of main unit 64 x 50 x 19mm: (G16) **$40**

GEIGER COUNTER KIT

Based on a Russian Geiger tube, has traditional 'click' to indicate each count. Kit includes PCB, all on-board components, speaker and Geiger tube: (K86) **$40**

HIGH POWER NEODYMIUM RARE EARTH MAGNETS

Very strong. You won't be able to separate two of these by pulling them directly apart from each other.

CYLINDRICAL 7 x 3 mm: (G37) **$2.50**

CYLINDRICAL 10 x 3 mm: (G38) **$5**

TOROIDAL 50mm outer, 35mm inner, 5mm thick: (G39) **$12**

ROD 10mm long, 4mm diameter: (G54) **$2.50**

SOUND ACTIVATED FLASH TRIGGER

Based on ETI project 514. Triggers a flash gun via an SCR when sound level received by an electret microphone exceeds a certain level. Adjustable delay between 5 and 200 milliseconds. LED lights to indicate if sound level is adequate. Take amazing picture like a light bulb breaking. PCB 62 x 40mm: (K61) **$18**

WIRELESS IR EXTENDER

Converts the output of any IR remote control to UHF. Self-contained transmitter attaches to IR remote. Kit includes two PCBs, all components, 2 plastic boxes, Velcro strap: (K89) **$39.** (9V battery not included). Plugpack for Rx (PP10): **$11**

WIRED IR REPEATER KIT

Similar to above kit, except transmitter and receiver are joined by a wire. Works with most remote controls: (K66R) **$20**

FM TRANSMITTER KIT - MkII

Ref: SC Oct 93. Low cost FM transmitter - 100m range, excellent frequency stability, tuning range 88-108MHz, supply voltage 6-12V. Easy to build, has a prewound coil in a shielded metal can. Includes PCB, all on-board components, electret microphone, 9V battery clip: (KII) **$13**

FM TRANSMITTER KIT - Mk III

Range to 200m. Has a pre-wound RF coil and limited deviation, so needs volume to be set higher on receiver. 6V at about 20mA: (K33) **$20**

MASTHEAD AMPLIFIER KIT

Our famous MAR-6 based masthead amplifier. 2-section PCB (so power supply section can be indoors) and components kit (K03) **$15.** Suitable plugpack (PP2): **$6** Weatherproof box: (HB4) **$2.50.** Box for power supply: (HB1) **$2.50** Rabbit-ears antenna (RF2) **$7** (MAR-6 available separately)

PC POCKET SAMPLER KIT

Ref EA Aug '96. Data logger/sampler, connects to PC parallel port, samples over a 0-2V or 0-20V range at intervals of one/hour to one/100uS. Monitor battery charging, make a 5kHz scope etc! Kit includes on-board components, PCB, plastic box and software (3.5" disk): (K90) **$30**

MODEL TRAIN CONTROLLER KIT

Ref SC Jul '95. Allows two trains to run on one loop of track without hitting each other. Detects when a train breaks an infrared beam and switches off power to an isolated portion of the track until the other train catches up and breaks another infrared beam at another section of the track. Has relay to switch track sections Main PCB 96 x 66mm, sensing PCBs 59 x 14mm: (K58) **$28**

TRAIN SOUND GENERATOR

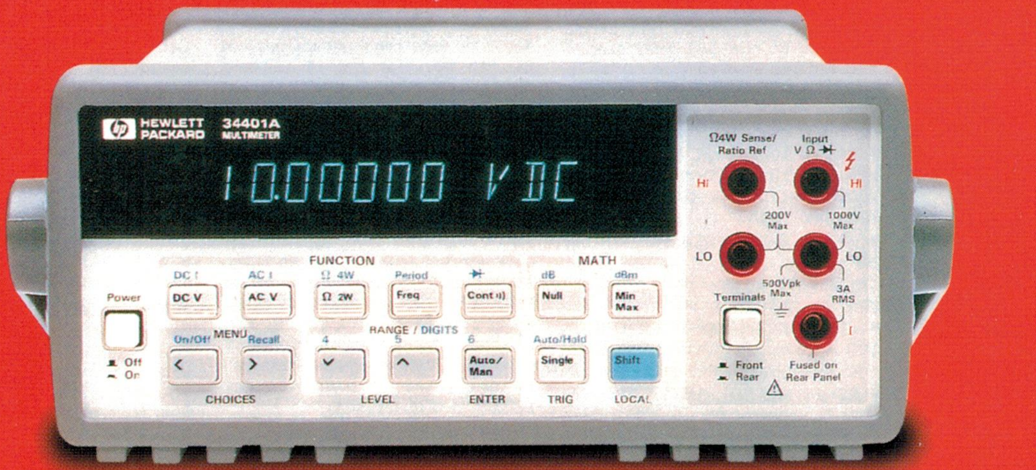
Ref SC Jul '95. Uses our SG1 COB (chip on board) train noise generator. Has voltage regulator for unregulated 8 to 15V DC operation. Miniature earpiece type 32Ω speaker included. Choose from level crossing bells, steam train whistle, locomotive chuffing, carriage passing track join. PCB 47x39mm: (K59) **$15**

OATLEY ELECTRONICS

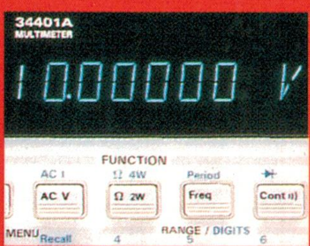
PO Box 89, Oatley NSW 2223
Phone (02) 9584 3563
Fax (02) 9584 3561
orders by e-mail: oatley@world.net
WEB SITE: http://www.ozemail.com.au/~oatley

major cards with phone and fax orders, P&P typically $6.

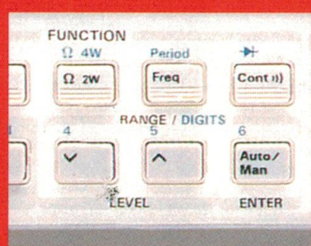
There are a number of reasons this HP DMM beats the competition.



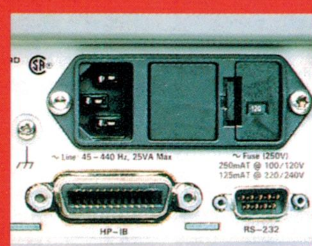
Pick any number you want.



1. Now you can get 6½ digit accuracy for the cost of 5½ digits.



2. All the measurements you expect, plus features that make checkout on the bench easy.



3. Both HP-IB and RS-232 interfaces are standard.

The numbers are clear: you get performance within budget, without compromise.

For less than the cost of a typical 5½ digit DMM, you can have the 6½ digit HP 34401A. You'll catch details that elude other meters, and with a dozen different measurement functions, you'll have more ways to tackle your test challenges.

Looking for speed? Technology leveraged from our 8½ digit DMM and custom ICs deliver up to 1,000 readings every second. That's up to 10 times faster than other DMMs in its class.

Get ready for an increase in personal productivity.

The HP 34401A boosts your productivity by combining time-saving features with an easy-access user interface. You're just a button press or two away from dc volts, dc current, true rms ac volts, true rms ac current, 2- and 4-wire ohms, frequency, period continuity, diode test, and even dB and dBm. Advanced tests include limit checks (pass/fail with a TTL output signal), min/max/avg readouts, and dc voltage ratios.

One call and you'll find out about lower price, higher performance, more capability, plus a three-year warranty. You'll also learn more about HP 34812A BenchLink/Meter software, which makes it easy to transfer data from your HP 34401A DMM to a PC. For your complete DMM solution, call HP today.

Australia 1800 629485
New Zealand 0800 738378

HEWLETT PACKARD